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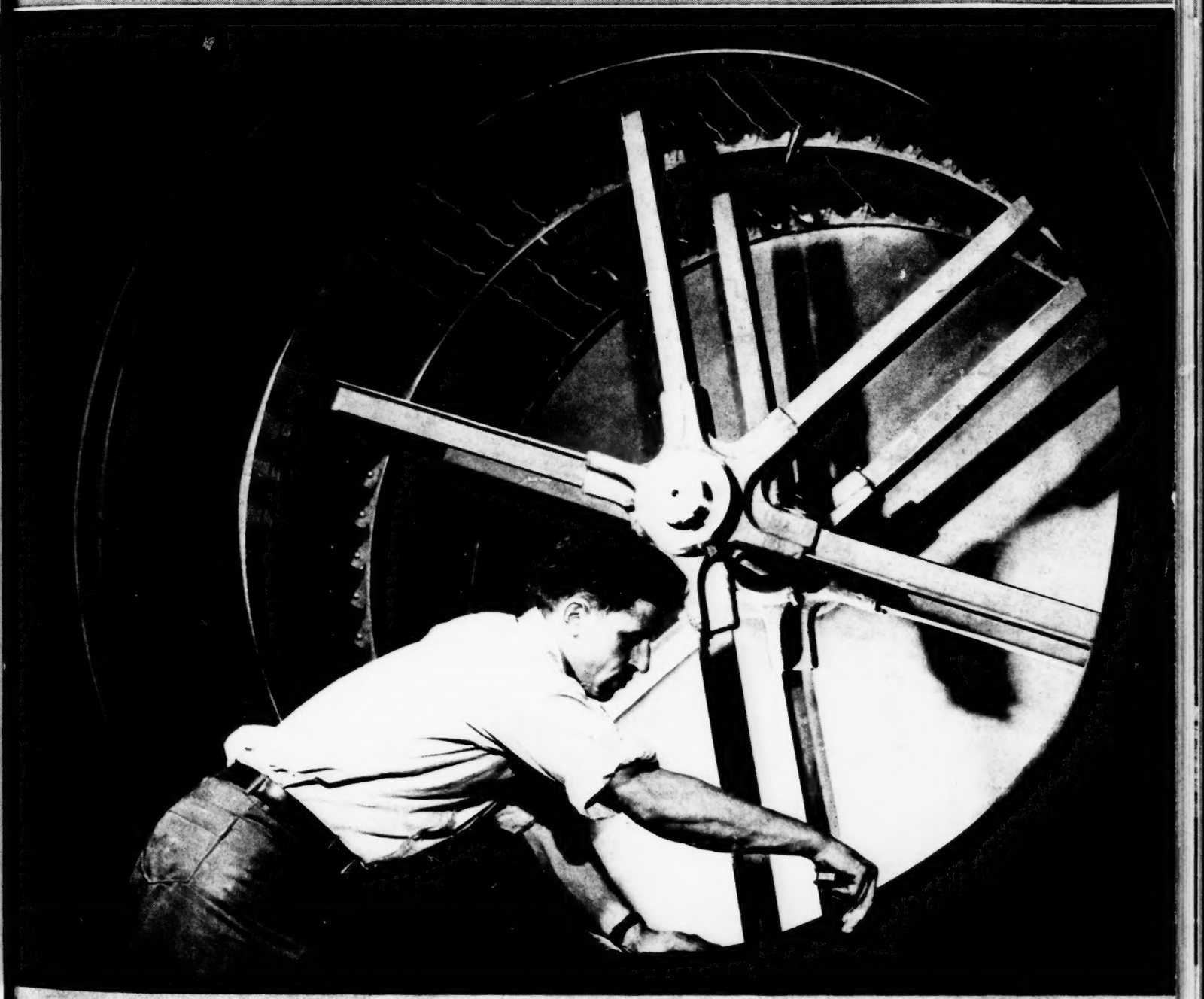
AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION



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What Happened at Cleveland . page 91

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PUBLISHERS OF MACHINERY & MACHINERY'S HANDBOOK
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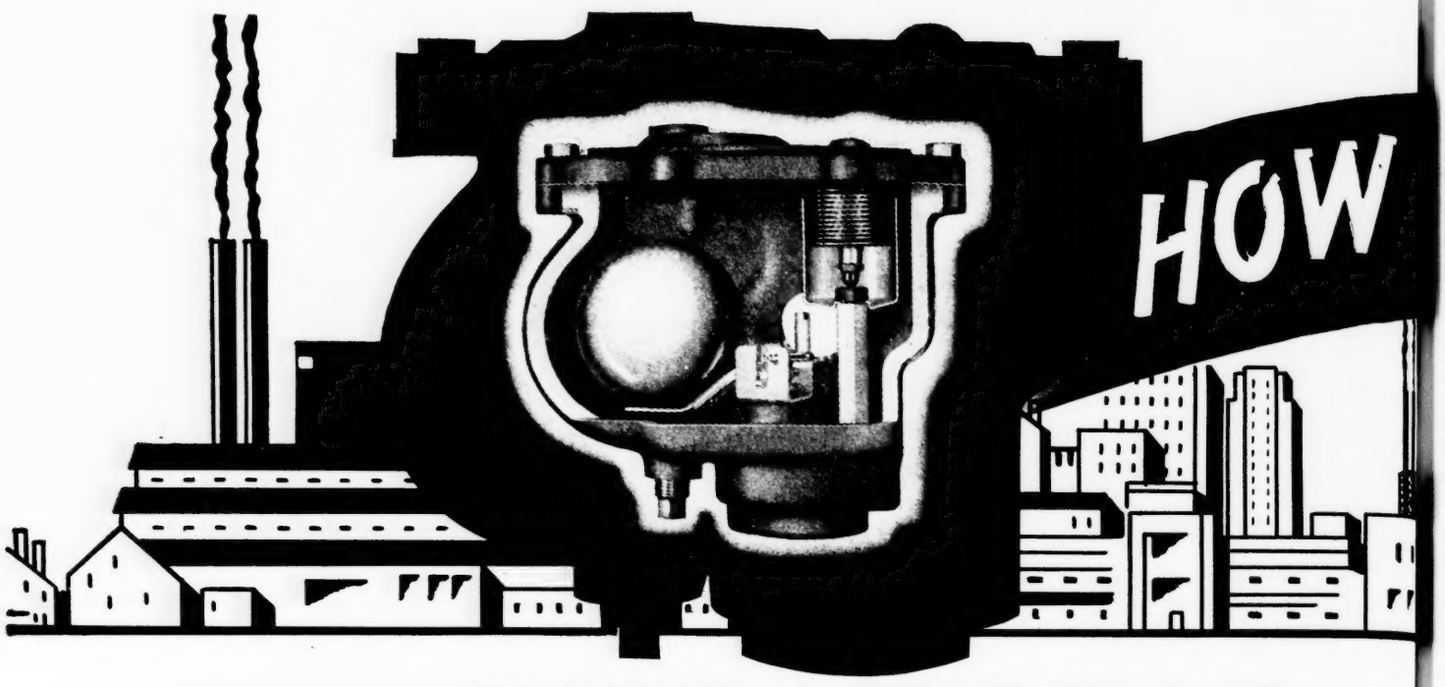
THIS MONTH'S COVER

A large exhaust fan recently completed by the Sturtevant Division of Westinghouse Electric Corporation.



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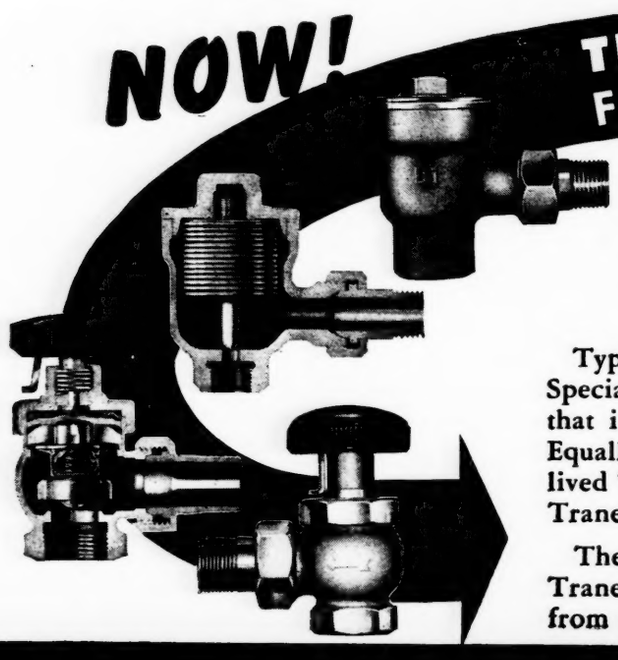

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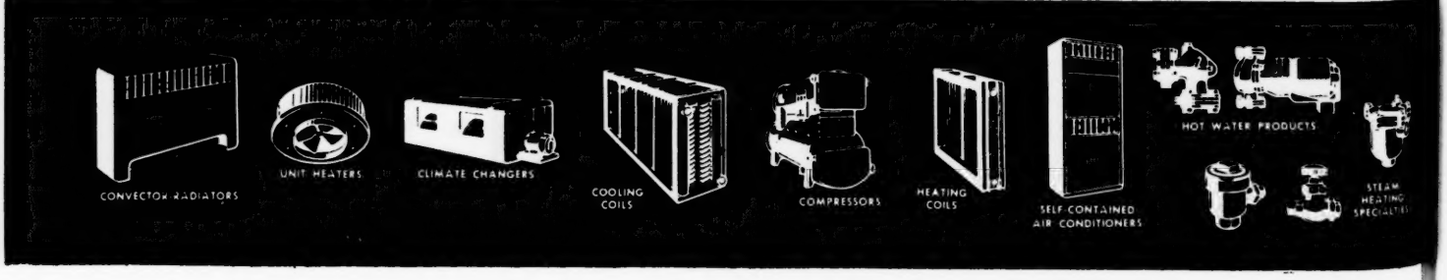

Washington News

LORING F. OVERMAN

Cooling Off Periods
Not Houses but Housing
Labor Outlook
Business Graph

If business, government, or labor ever needed an example of the tempering effects of a "cooling off period", happenings during January at the Nation's capital certainly provided it.

A Republican Congress arrived with the bit in its teeth, ready to tear labor to pieces; to rip the federal budget to shreds; to slash income taxes; to effect overnight all of the reforms the new legislators felt they had been vote-mandated to change. The month wound up with most members of Congress thinking: "Let's take another look."

Labor started the month with announced intentions of making a desperate drive for another round of wage increases; with nearly $5 billion worth of portal-to-portal suits filed against industry; with crippling strikes in the steel and automotive industries, among others, threatened "unless". By January 31 the prospect of big-industry strikes were fading; A. F. of L. had come out flatly against portal-to-portal suits; C.I.O. had withdrawn some of its portal suits, and was offering to compromise others if a legal basis for such compromise could be worked out.

Prices, released in November from O.P.A. restraint, reflected during January the expected upward spurt —then began to flatten in some lines.

The National Housing Agency, committed last year by Wilson Wyatt to a program of "veterans housing or nothing", came out with what is called a "realistic" program.

All in all, Washington had a rousing change of management celebration during January, with everyone getting his name in the paper or in the Congressional Record—but with the month winding up pretty much on the business-as-usual note.

Realistic Housing

For those who plan, execute and distribute in the heating, ventilating and air-conditioning fields, what the 1947 course will be is perhaps best indicated by a new policy announcement of the National Housing Agency. Its major objective, the Agency announced on January 25, will be to promote the building of new rental housing. Not "houses", but housing, which will include much of the multi-unit construction in which readers of this publication are concerned. Other points in this year's program include:

(1) Completion of 1,000,000 homes and apartments and putting 1,000,000 additional housing units under construction.

(2) Restoration of normal construction time.

(3) Increased production of materials and gradual relaxation of controls.

Two other significant factors will have a bearing on 1947 construction trends.

(1) Easing of rent controls in hardship cases has already been authorized, and a Bill to permit a flat increase of 15% in rents has been introduced in Congress. While the figure may be pared somewhat if and when the Bill is passed, legislators are finding it increasingly difficult to ignore relators' pleas that theirs is an industry remaining under strict control while all of their costs have been permitted to find their own level.

(2) The limitation on non-residential housing will be continued, but an increase from $35 million to $50 million has been made in the weekly average quota for non-housing authorizations. This would permit, roughly $2.5 billion worth of non-housing private construction during 1947—a figure which may be permitted to expand further during the latter half of the year, when it is expected that additional building materials will be available.

Although the $2.5 billion limitation upon private non-housing construction would, if carried through, bring the 1947 total somewhat below the 1946 figure of $3.2 billion, even the smaller figure represents a tidy sum upon which to make plans for the year. To this may be added a couple of billions of dollars worth of Government-financed engineered construction, including an estimated $225 million for construction of new schools. Despite strikes, restrictions and shortages of both labor and materials, total engineered construction for 1946, including that Government-financed, was reported at $5,176,034,000 for 1946—126% above 1945. Privately-financed portion of the total was 176% above '45.

Housing Bill Again

With NHA retreating somewhat from the Wyatt position of controlling housing construction, it is interesting to note that the Wagner-Ellender-Taft public housing bill (it passed the Senate at the last session of Congress, but not the House) is to be introduced again soon with minor changes. The bill takes the position that private industry cannot be depended upon to provide certain types of housing, particularly for low-income groups.

The bill proposes to bunch under one agency the activities now carried on by the Federal Housing Administration, Federal Home Loan Bank Board and the U. S. Housing Authority. The main provision of the bill calls for FHA insurance coverage of new homes for low-income people up to 95% of the dwelling's value. Interest at 3½% was provided under the original bill, but in the new version it may be raised as high as 4%.

Another clause calls for a five-year program of land assembly, slum clearance and the like; another for a separate rural housing program. Still another allocates $37,500,000 for five years of technical and market research with reference to housing, local communities

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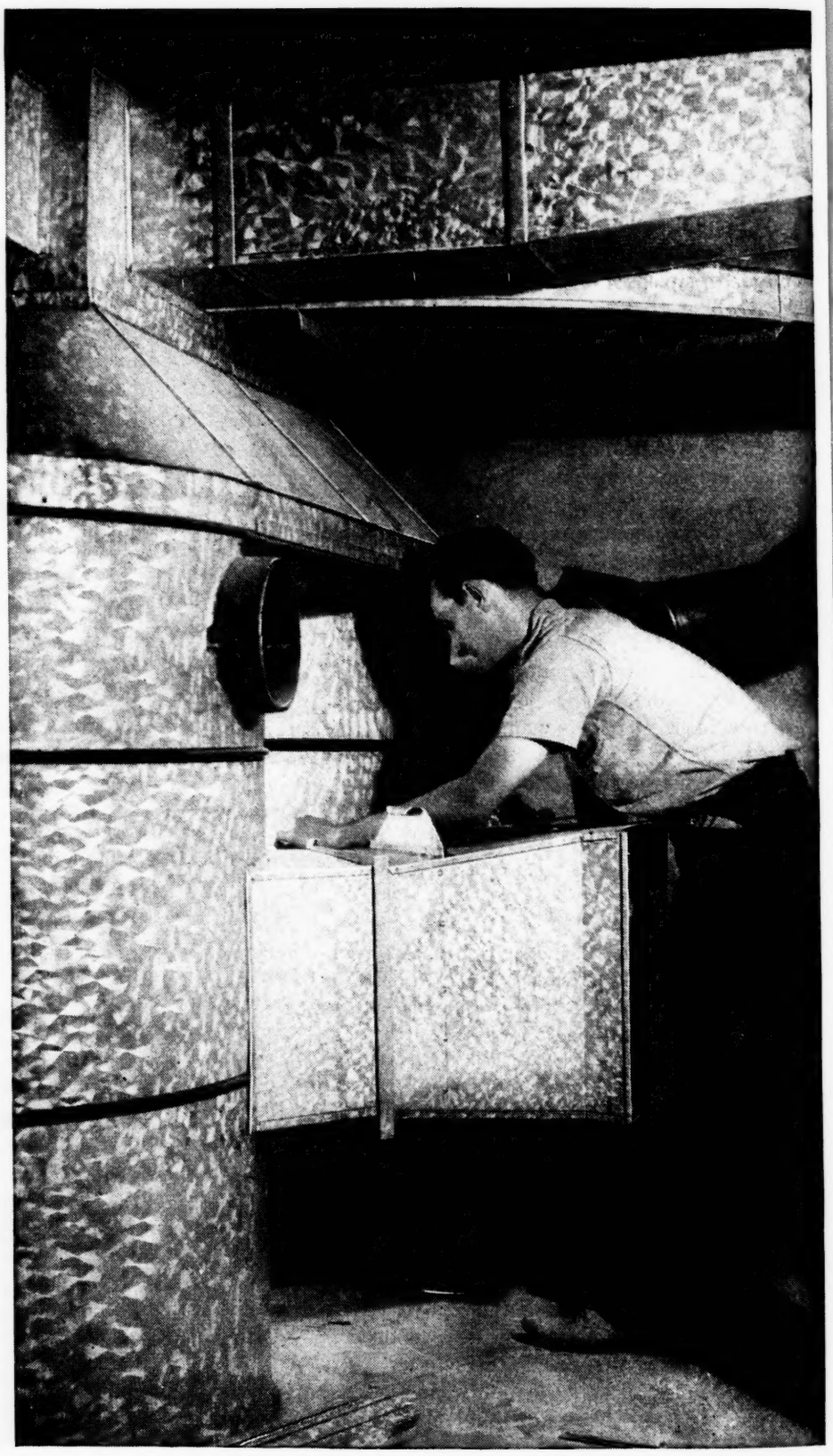

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to add $25,000,000 to the Federal funds. Proponents of the bill, including Senator Taft, contend it is necessary if building is to be stimulated to some 1,000,000 dwelling units for the next 10 years. The previous record under private industry was 937,000 units, in 1925. Peak cost of the program would be $143,000,000 per year to taxpayers. Most of the Federal aid would go to people who can afford homes costing $6,000 or less, or who can pay rents of $50 or less per month.

Next Bottleneck?

There are indications that unless immediate steps are taken to train new workers in all construction fields, the return of building materials and equipment to normal supply will be attended by a severe shortage of skilled workmen. Steps to anticipate this situation are being taken at all levels by associations of heating, piping and air-conditioning contractors. If results achieved by the Washington, D. C. association may be accepted as typical, the industry is doubtless well on the way to a solution of this next problem. If the Washington experience is an isolated example, the blueprint it affords may be worthy of further study.

Lloyd B. Gouman, executive secretary of the association, acts also as secretary of the Washington, D. C. joint apprenticeship committee, which includes three members of local unions and three members of the association. Working on an apprenticeship ratio of 1 to 5, the program has "graduated" 42 qualified workers during its period of functioning, with training continuing for others.

Another forward step, taken at the national level recently in Atlantic City at the suggestion of the respective unions, authorized the issuance of a universal card for plumbers and steamfitters. Considerable coordination between unions and local associations will be necessary before the full effects of this authorization will be realized, but good progress has been made in applying its principle in the Washington, D. C. area.

General Labor Outlook

The foregoing example of the ability of labor and management to cooperate at local levels may reflect, or perhaps may be influencing, a noticeable change in the overall labor picture. While it is difficult to tell which is cause and which effect, it is apparent that Congress is tempering its threats to give labor the works, while labor, in turn, is far less vocal than in the recent past.

True, Congressional hoppers are brimming with proposed legislation that would do just about everything from repealing the Wagner Relations Act outright to making strikes in major industries a form of treason. It is admitted, however, that a Congressman can, with impunity, initiate proposals to please certain constituents, knowing in advance that by the time all of the varied versions get through Committee and onto the floor of the House or Senate, the recommended measure may contain little or none of the dynamite he implanted.

Thus the new Congress, by introducing scores of Bills to temper the powers of labor organizations, has shown its constituents and labor leaders that "it means business". Similarly, labor leaders seem to have accepted the threats as very real, and have called off their dogs pending further developments. Lulled by the apparent lack of need for drastic action, and cognizant of the fact that labor will vote again in 1948, Congress is studying the labor problem from more "practical" angles.

As a result it would appear that such drastic proposals as a closed-shop ban and an end to industry-wide bargaining may be merely talk, and that union powers will be only mildly tempered. Indications are that portal-to-portal claims will be limited materially; Fair Labor Standards Acts provisions will not be weakened greatly after limiting retroactive liability; Wagner Ach changes will be mild; mediation will be broadened, and unions may be required to register and report finances.

The Business Graph

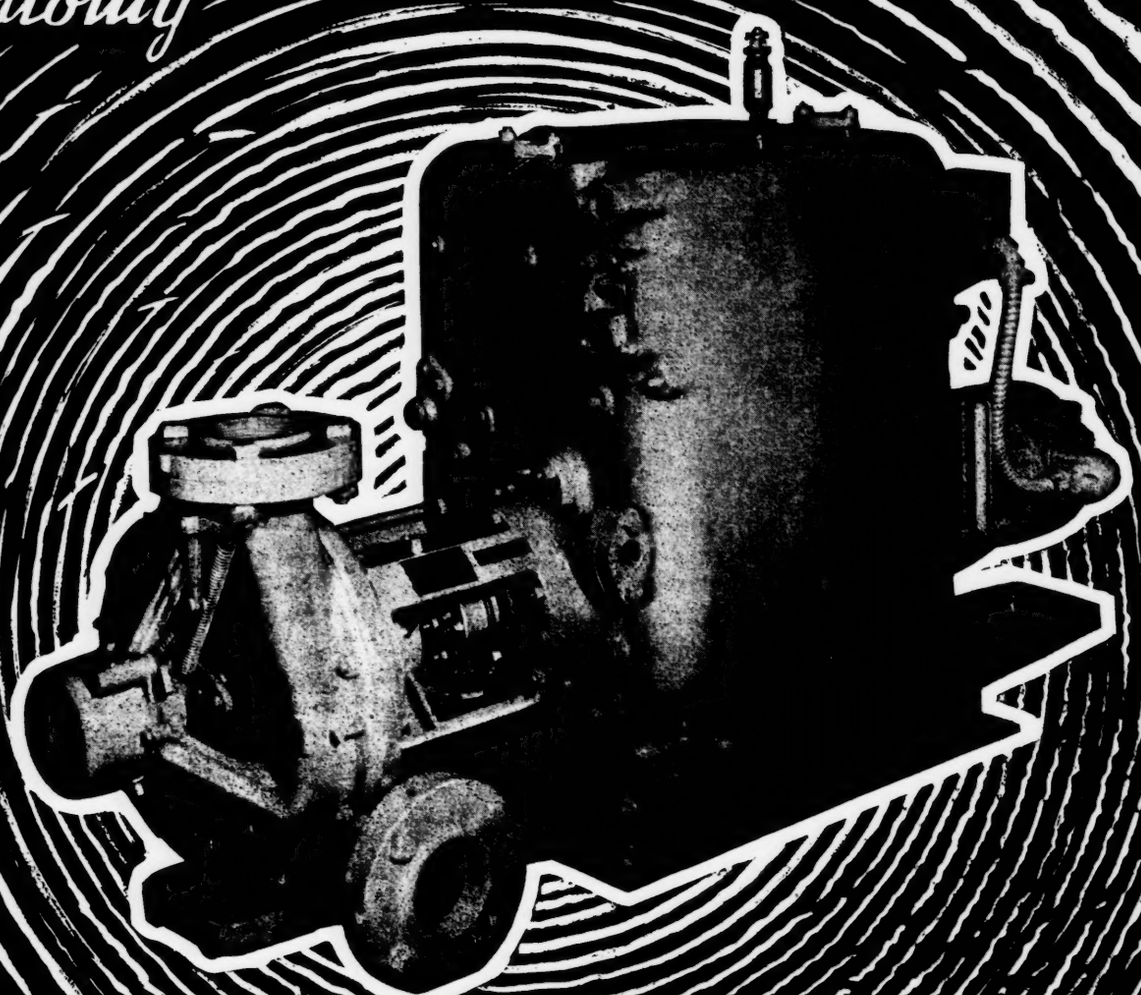
Doubtless a major cause for sober thinking on the part of both industry and labor—and both sides employ good economists who can read the figures right if they wish to—is the question mark appearing on business charts and graphs. In selected lines—notably apparel, furs, jewelry and soft goods in general—the downward trend is marked. Among the durables, the trend is still up. Inasmuch as this latter group includes heating, ventilating and air-conditioning equipment, the question arising is whether the break in soft goods prices is the forerunner of a similar break in demand for durables.

Washington economists think not—yet. Many are referring to 1947 as a "shake-out" year; one in which prices too high will settle, others come to the top. They point out that manufactured goods have gone up 60% (1939 to 1946) while food advanced 125% and farm products 150%.

On the demand side they rate consumer durables in a strong position, reflecting an expected construction program total of 20 to 22 billion dollars. Housing is expected to account for 40% of this, with repair and maintenance 5 billion. The high level of construction cost is admittedly a big obstacle, likely to defer some commercial and industrial building.

That 1947 will be a year requiring keen business insight is the tone of economic reports circulating in Washington, including the President's Economic Report to Congress. An immediate recession in some lines is in evidence — the extent depending upon whether human nature, seeing a retreat from the price line, holds off its buying in the hope of even further retreats. With spendable income running 91% higher than in 1929, it is not believed that buyers will "strike" too long on any individual line, with the result that downward trends are expected to halt quickly, leveling off not too far below present levels—possibly 10% to 15%. Danger that a break in soft goods prices may spread to durables is considered slight, for demand for such products has been far behind supply throughout the war, with little likelihood of catching up for many months.

Centralized Heating Economy



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Temperature Distribution in an Experimental Low-Cost House

RICHARD S. DILL and PAUL R. ACHENBACH

National Bureau of Standards†, Washington, D. C.

The comparative uniformity of temperature distribution produced by various types of heating devices or systems was determined in a Test Bungalow at the National Bureau of Standards. The heating appliances tested included a hot water heating system, floor furnaces located in several different positions, space heaters with fans, and electric and oil-burning warm-air furnaces. Each heating device was observed under a variety of weather conditions. The conditions inside and the weather outside the Test Bungalow were recorded for comparison.

At the time of these tests, the bungalow was exposed to the weather as shown in Fig. 1 above. It has since been enclosed in a refrigerated structure so that conditions around it can be more readily duplicated.

This is part 1 of a 2-part article presenting a condensed report of the results of these tests. A complete report will shortly be published by the National Bureau of Standards under the authorship of Messrs. Dill and Achenbach in one of the Bureau's Building Materials and Structures Reports.

THE desirability of a heating system depends on its first cost and economy of operation, on the amount of smoke, soot, or dirt occasioned by operation, on the amount of care and attention it requires, and on the temperature distribution it produces throughout a house. The last characteristic might be called the quality of its performance.

Information on efficiency, soot deposition, and attention requirements of a heating device can be obtained by laboratory tests, but quality of performance, as defined above, can only be determined by actual trial in a house. Therefore, a full scale house was constructed at the National Bureau of Standards in which entire heating systems could be installed.

One of the main purposes of the work in this house was to obtain data on temperature distribution produced by various heating devices intended

†The National Bureau of Standards is a fact-finding organization; it does not "approve" any particular material or method of construction. The technical findings in this series of reports are to be construed accordingly.

Table 1—Average Temperatures at Various Levels at Outside Air Temperatures Near 32F with Experimental Warm Air Heaters *

Height Above Floor, Inches	Air Circulation Method			
	*Gravity	Forced Intermittent (780 cfm)	Forced Intermittent (1460 cfm)	Forced Intermittent (1460 cfm)
	Outside Temperature, F			
	28 to 32	28 to 32	22 to 26	34 to 38
	Average Temperature, F, for Five Rooms			
2	64	59	59	62
30	72	69	69	69
60	80	77	74	71
78	91	84	76	73
94	103	89	79	73
$DT_2/DT_1 \times 38$. For explanation, see Text				
	14.0	15.8	13.4	10.5

*Heated electrically for experimental purposes.

for low-cost houses so that estimates could be made of the performance of these heating methods in similar houses designed for occupancy. The house is a one-story bungalow designated as the Test Bungalow in this report. An exterior view of the Test Bungalow is shown in Fig. 1, shown at the top of the previous page.

Uniformity of temperature is never quite achieved in practice, and the data presented in this article indicate what departures from uniformity are to be expected in houses similar to the Test Bungalow when heated with several types of heating devices. Data in this article are intended to assist in determining the degree of variability in heat distribution that can be or should be tolerated.

Appliances tested include a hot water heating system, floor furnaces located in several different positions, oil and gas space heaters with fans, and electric and oil-burning warm-air furnaces.

Test Bungalow

The Test Bungalow has four rooms and bath, floor plan of which is shown in Fig. 2. All rooms except the bath, including the hallway, are provided with movable ceilings that can be adjusted to any height between 7 ft and 9 ft by permanently installed overhead screw jacks. During the tests described in this report, the ceiling height was 8 ft. The bungalow is provided with a full basement in which heating systems can be installed for comparison with devices located on the first floor.

The outside walls of the Test Bungalow are conventional in construction and consist of 2 x 4 studding with sheathing and lap siding on the outside, separated by a layer of building paper, and ½-in. gypsum board on the inside. The walls are not insulated. The bungalow has a double floor of 1 in. pine. The ceiling consists of ¼ in. plywood supported by a framework of 2 x 4 in. timbers. A blanket of wood-fiber insulating material 2 in. thick was placed on top of the plywood. The windows are double hung except the one in the bathroom and one of those in the kitchen. Window frames and sash are of wood. There is no weatherstripping around windows or doors.

Conductance of the side walls averaged 0.276 Btu per sq ft per hr per F.; conductance of the floor from the upper floor surface to the basement air was 0.363; and conductance from the under surface of the ceiling to the attic air was 0.166.

Thermocouples suspended from the ceiling by strings were used to measure air temperatures in the Test Bungalow. Five strings were hung in each room, one at the center and one midway between the center and each corner of the room. Five thermocouples were attached to each string, at points 2, 30, 60, 78, and 94 in. above the floor. These thermocouples were insulated to minimize the effect of cycles of the heater and were aluminum foil wrapped.

A room thermostat having a bimetallic temperature-sensitive element controlled the operation of automatic heating devices. The thermostat was located on the inside wall of the living room, 30 in. above the floor.

Systems Tested

Temperatures in the Test Bungalow were observed when heat was being supplied in turn by an experimental electric heater, an oil-burning warm-air furnace, a jacketed gas-fired space heater, a jacketed oil-fired space heater, a single gas-burning gravity floor furnace, two gas-burning gravity floor furnaces, a gas-burning floor furnace with forced circulation, an oil-burning gravity floor furnace, and a conventional gravity flow hot-water heating system.

Electric Heater. The experimental electric heater consisted of a vertical, rectangular metal duct, 17 by 23 in. in cross section, lined with transite board, having 30 socket-type electric heaters, each of 660-watt capacity, mounted on the inside. The bottom of the heater was open to receive return air from the house, and the device was supported 12 in. from the floor by legs. The warm-air outlet of the heater was connected by a sheet-metal duct to a plenum chamber overhead.

The plenum chamber was approximately 11 in. high by 24 in. square. Warm air was supplied to each room

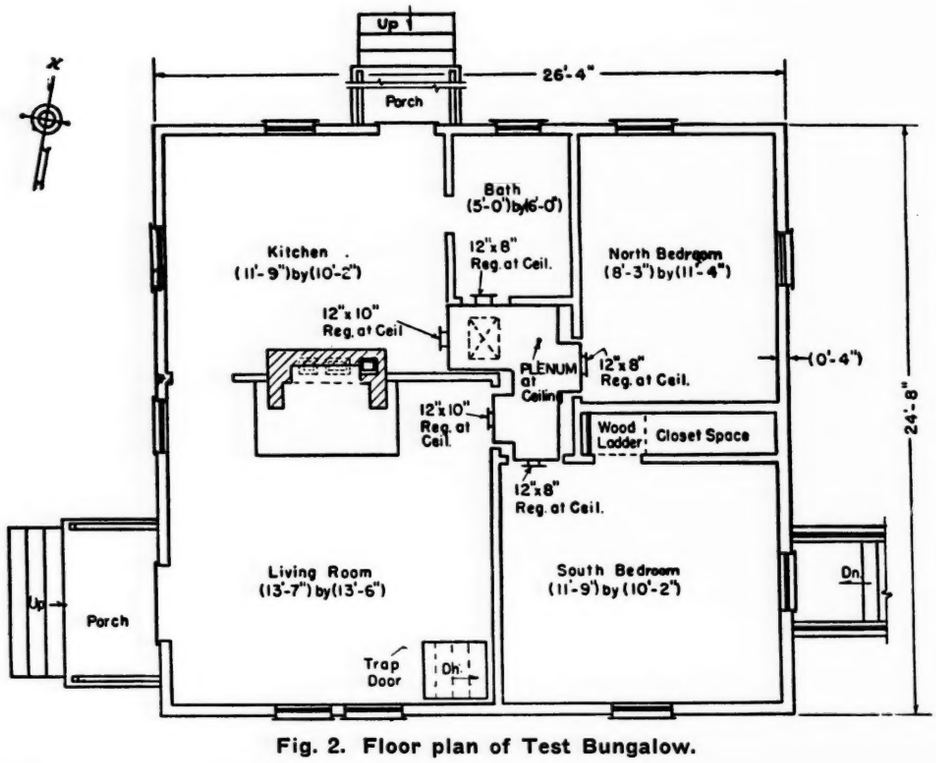
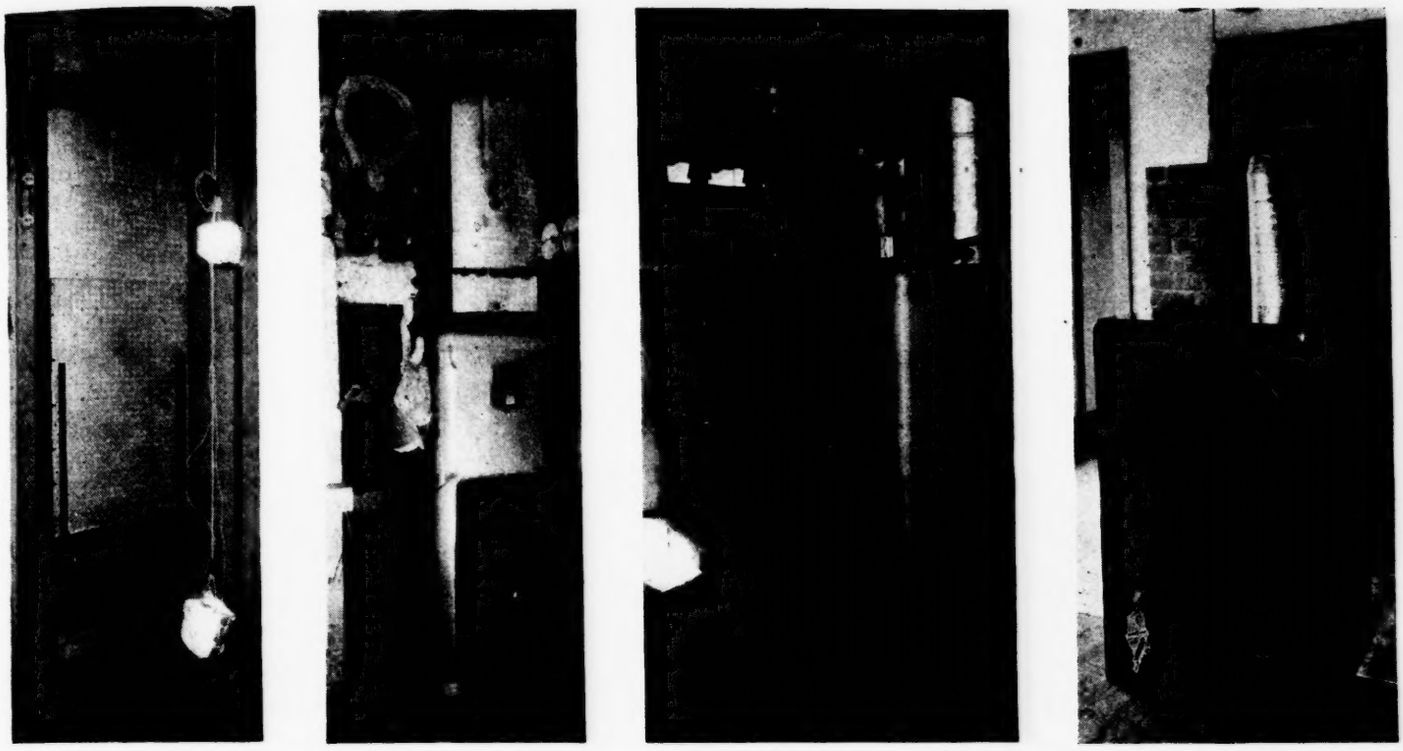


Fig. 2. Floor plan of Test Bungalow.



(Left to Right) Fig. 3. Electric heater with blower attached. Fig. 4. Oil-burning warm-air furnace in position used for the tests. Fig. 5. Oil-fired boiler and a companion coal-fired boiler of the same model. Fig. 6. Jacketed gas-fired space heater in position used for the tests.

from the plenum by a short duct. The plenum and ducts occupied the space in the hallway between 7 ft and 8 ft above the floor. The shape and location of the plenum chamber and ducts are shown in the floor plan, Fig. 2.

For tests with forced circulation, the heater was raised to accommodate a centrifugal blower which was installed underneath it (Fig. 3). A magnetic switch with a suitable relay permitted the thermostat to start and stop both the electric heater and the blower. The blower circulated air through the heater, plenum chamber, ducts, and rooms.

The electric heater was used for tests with gravity circulation, with intermittent forced circulation of air at rates of 780 cfm and 1,460 cfm, and with continuous forced circulation of air at a rate of 1,460 cfm. Some of the results on the electric heater tests are given in Table 1.

Oil-Burning Furnace. The oil-burning warm-air furnace (Fig. 4) was of the cabinet type having a top outlet and a wide inlet above the floor. A disc fan capable of delivering about 650 cfm against a static pressure of 0.12 in. of water circulated air around a single heat-transfer cylinder. The furnace had a natural-draft, pot-type burner 13 in. in diameter, operating on high and low fire as required. The operation of the furnace was completely automatic, with the room thermostat controlling the fuel supply to the burner and the bonnet temperature controlling the operation of the circulating fan. The rate of oil supply to the burner on high fire was 0.55 gal per hr; the manufacturer's output rating on high fire was 55,000 Btu per hr. This heater was connected to the plenum chamber and duct system previously described.

Oil-Fired Space Heater. The oil-fired space heater was jacketed, and equipped with a disc fan that could be used to circulate air downward around the combustion drum and deliver it near the floor through a grille in the front and one in the side of the heater. The heater was also used to heat the bungalow by gravity circulation, with the warm air being delivered from the top of the heater. The unit was equipped with a natural-draft pot-type burner 13 in. in diameter. The oil supply to this unit was manually controlled. It had a maximum output of about 35,000 Btu per hr. This heater also was placed in the living room in front of the fireplace opening, and the heat was permitted to overflow into the other rooms through the open doorways.

Oil-Burning Gravity Floor Furnace. The oil-burning gravity floor furnace was installed in the floor of the hall. The warm-air discharge and the cold-air return were incorporated in a single register measuring 22 by 30 in. A pot-type vaporizing burner with automatic electric ignition was used in the furnace. The operation was automatically controlled by the room thermostat during the tests. The input rating of the furnace was 70,000 Btu per hr.

Oil-Fired Gravity Hot-Water System. The gravity hot-water heating system was of the conventional type and was designed in cooperation with the Heating, Piping, and Air Conditioning Contractors National Association. The boiler was a rectangular, cast-iron

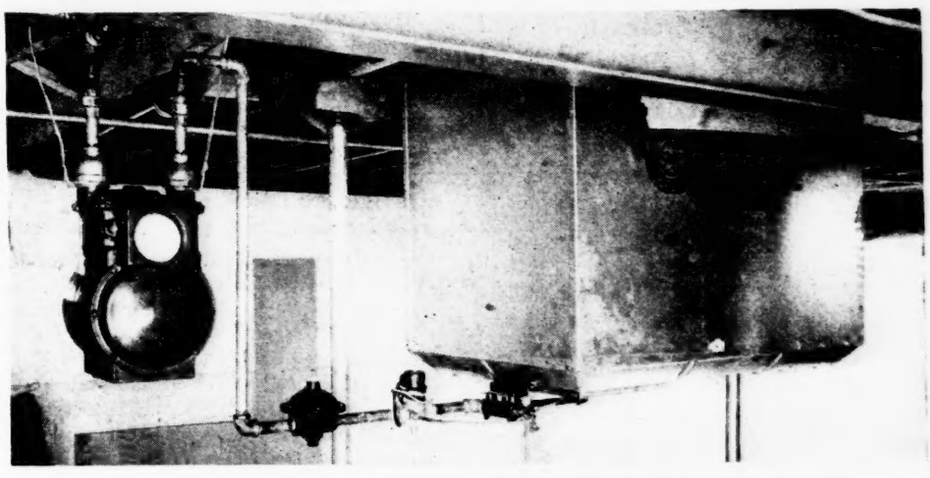


Fig. 7. Single gas-burning floor furnace, gravity type, shown from under the floor.

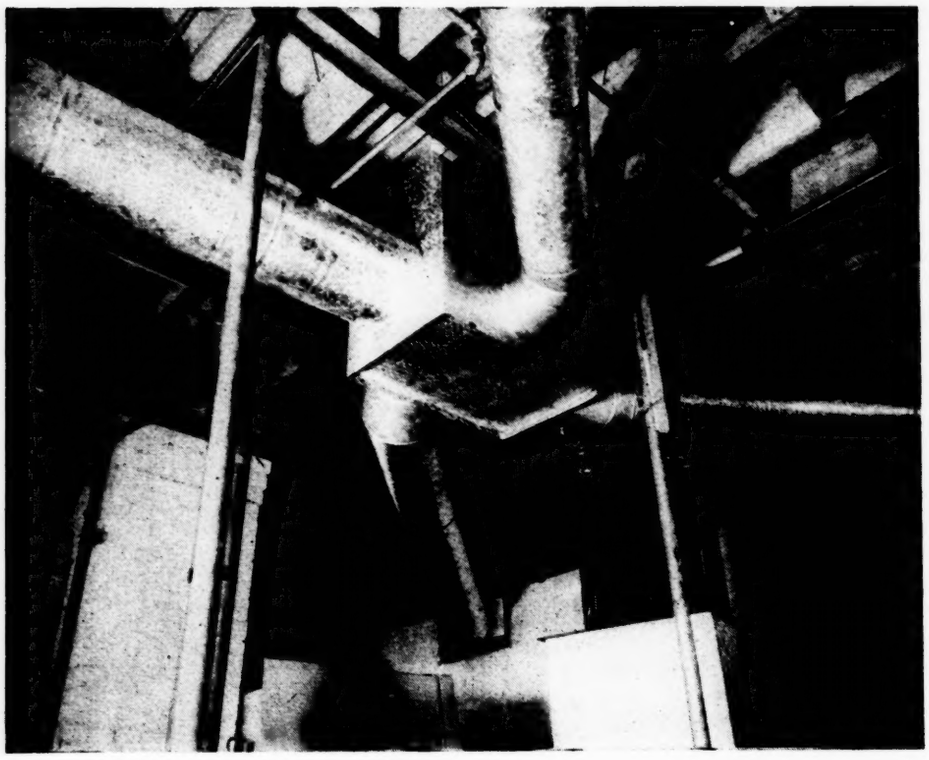


Fig. 8. Manner in which cold air returns were connected to the casing of the gas-burning floor furnace with circulating fan.

boiler of three sections, with a wet base, and fired with a gun-type oil burner, controlled by a room thermostat and an immersion aquastat connected in series. Small-tube radiators were used to warm the rooms.

Fig. 5 shows the oil-fired boiler and a companion coal-fired boiler of the same model that was installed for making comparisons in performance. No data on the coal-fired boiler are presented at this time.

Some of the results of the oil-fired equipment tests are summarized in Table 2.

Gas-Fired Space Heater. The gas-fired space heater was jacketed and was equipped with a disc fan 18 in. in diameter mounted on the back. The fan forced air through openings in a cast-iron heat-transfer element and a circular grille 21½ in. in diameter with deflecting vanes. The grille was located in front of the jacket and could be rotated in the jacket to deliver warm air in a desired direction.

The burner was controlled by a room thermostat, and the fan operation was controlled by the temperature of the heat-transfer element. The heater was placed in the living room in front of the fireplace opening for the tests. The movement of air to and from the other rooms took place through the open doorways. The specimen heater is shown in Fig. 6 in the position used for the tests.

Single Gas Floor Furnace. The single-gas-burning floor furnace of the gravity type was installed in the floor of the hall in the conventional manner. It had a rated input of 70,000 Btu per hr. The warmed air was discharged from the furnace and the cold air was returned to the furnace through a single large grille measuring 26 by 38 in. The return air passed over the floor and entered the hall from all the rooms through open doorways. Fig. 7 shows the gravity floor furnace.

Two Gas Floor Furnaces. Two gas-burning gravity floor furnaces operated simultaneously in the bungalow during one series of tests. Each had a rated input of 35,000 Btu per hr. The warm air outlet and the cold air return of each furnace were at floor level and were incorporated in a single register measuring 18 by 32 in. One furnace was installed in the hall and the other in the living room under the south windows 15 in. from the wall. Both furnaces were controlled during the tests by one room thermostat, located on an inside wall of the living room.

Gas Floor Furnace with Fan. The gas-burning floor furnace with the circulating fan was installed in the hall. A plenum chamber 6 in. high was built over the furnace above the floor level and suitable openings permitted the warmed air to be forced toward the

Table 2—Average Temperatures at Various Levels at Outside Air Temperatures Near 32F with Oil-Burning Heaters

Height Above Floor, Inches	Heating System				
	Oil Furnace in Utility Space, Intermittent, Forced through Plenum	Jacketed Oil Heater in Living Room, Gravity, Circ.	Jacketed Oil Heater in Living Room, Air Circ. by Disc Fan Inside Jacket, Downward Flow	Oil Floor Furnace in Hallway, Gravity Circulation	Oil-Fired Hot Water Boiler in Basement, Gravity Circulation (Basement at 75F)
	Outside Temperature, F				
	22 to 26	43	48	31	32
	Average Temperature, F, for Five Rooms				
2	59	64	69	61	67
30	70	70	78	69	69
60	83	77	84	78	72
78	91	89	87	82	74
94	96	95	89	83	75
	$DT_2/DT_1 \times 38$. For explanation, see text.				
	19.1	—	—	16.0	5.7

Table 3 – Average Temperatures at Various Levels at Outside Air Temperatures Near 32F with Gas Heaters

Height Above Floor, Inches,	Heating System			
	Jacketed Gas Space Heater in Living Room, Air Circ. by Disc Fan Inside Jacket	Gas Floor Furnace, Gravity Circulation	Two Gas Floor Furnaces, (Living Room and Hallway), Gravity Circulation	Gas Floor Furnace, Air Circ. by Disc Fan Inside Casing, Connected Returns Under Floor
	Outside Air Temperature, F.			
	37	34	27	35
	Average Temperature, F, for Five Rooms			
2	60	60	60	63
30	68	69	68	69
60	76	77	74	71
78	80	81	77	71
94	81	82	77	72

doorways of the surrounding rooms just above the floor. In practice the furnace and its plenum would be placed in a closet or under a stairway adjacent to the hall, but this location was only simulated in the Test Bungalow to eliminate excessive changing of partitions. The circulating fan was of the propeller type. It was mounted in a vartical position under the heat transfer element and was used to circulate the air through the heater and the house.

Cold-air returns under the floor connected the furnace casing to a floor register near an outside wall in each room except the bath. The ducts serving the two bedrooms were 9 in. in diameter while those serving the living room and kitchen were 12 in. in diameter. The furnace was automatically controlled by a room thermostat and a bonnet switch in the conventional way.

Fig. 8 shows the manner in which the cold-air returns were connected to the furnace casing.

Some of the results from the gas equipment tests are summarized in Table 3.

Summary of Test Procedure

Each heating system was operated for several days to assure temperature distribution characteristic of the heater. The automatic devices were controlled by a room thermostat placed 30 in. above the floor on an inside wall of the living room. The setting of the thermostat remained at 70F continuously during these tests. The manually controlled units were readjusted to maintain approximately 70F at the 30-in. level. Each heater, when installed, was adjusted in accordance with the manufacturer's instructions.

At the time of these tests, the bungalow was exposed to the weather. It has since been enclosed in a refrigerated structure so that conditions around it can be more readily duplicated.

Analysis of Results

Vertical Temperature Differences. The average temperatures obtained at five levels in the rooms with the various devices tested are summarized in Tables 1 to 3. The average difference in temperature between the 2-in. level and the 60-in. level above the floor and that between the 2-in. level and the 94-in. level were tabulated for each room but are not presented here; the averages for the entire house for each device are shown in Tables 1 to 3. The 94-in. level was 2 in. below the ceiling.

The data presented for each device are those that were obtained when the outdoor temperature was as near to 32F as occurred during the test period.

From the standpoint of comfort the temperatures from the floor to five feet above the floor are more significant than the temperatures at higher levels. However, an appreciable amount of heat will be radiated from the ceiling when it reaches a high temperature; this radiation may be of importance in maintaining warm floors, depending upon the conditions. High temperatures in the upper parts of the rooms will affect the heat loss from the building materially, especially if the ceiling is not insulated from the attic.

The last column in each of Tables 1 to 3 show that the average temperature differences produced in the Test Bungalow between the 2-in. level and the 60-in. level with continuous forced circulation of air through a plenum chamber, with a forced circulation gas floor furnace, and with a gravity hot water heating system where less than 10F for low outside temperatures. The average temperature difference produced in this same zone by all the other devices tested ranged from 14 to 26F between the level 2 in. above the floor and 60 in. above the floor at comparable outside temperatures.

The same heating devices or heating systems that produced the lower temperature differences from the 2-in. to the 60-in. levels also produced lower temperature differences from the 2-in. level to the 94-in. level. Except for the case of the electric heater when used with a continuous circulation of 1460 cfm of air (Col. 4, Table 1), the heating devices operating with the plenum chamber at the ceiling in the hall produced higher temperature differences between the floor and the ceiling than the other devices tested. This condition was to be expected since the method of introducing the warm air did not diffuse it throughout the lower parts of the room.

It was found that, at an outside temperature of 48F, the use of a disc fan to force air downward through a space heater and thence across the living room near the floor caused the zone below the 60-in. level *in that room* to be warmer than it was with gravity circulation, but also that the fan caused the air 2 in. above the floor in the other rooms to average 4.5F lower than was the case when gravity circulation was used. The air in the lower 60 in. of the living room was warm enough for comfort with gravity circulation of air through the space heater jacket.

Next month the authors discuss horizontal temperature differences and general experimental results.

Give Your Fan a Chance

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A point of view regarding fan operation that may result in a better understanding of what the fan is expected to do, and what should be expected from fan manufacturers.

SINCE a buyer does not like to get less than that implied by the purchase contract, the question naturally arises as to when the customer gets what he buys.

For example, if a manufacturer sells a wood chisel which the purchase uses to cut wire or nails, the manufacturer can hardly be blamed for a dulled, nicked cutting edge since the product was not properly applied.

Or, suppose a contractor is planning on heating a small garage. He calculates the heat required, consults a reliable manufacturer's catalog and selects the coil of Fig. 1 which will properly answer his Btu requirements, steam pressure and entering air temperature. He notes also the face velocity and the coil's resistance to air flow.

Next, he studies another section of this same catalog to select a fan, the wheel of which is shown in Fig. 2, to meet the velocity, volume and coil resistance requirements tabulated for the coil of Fig. 1. The fan rating table also provides the fan speed and the fan horsepower

Now, in still another section of the manufacturer's catalog, he locates the motor of Fig. 3 which will match the fan characteristics previously noted.

Since the contractor decides to hold the amount of ductwork to a minimum, he assembles the coil in an attractive cabinet with fan and motor mounted as shown in Fig. 4. He even utilizes a streamlined entrance to the cylinder surrounding the fan. On the side of the cabinet where the air leaves the coil, he installs adjustable louvers so the garage owner can control the direction in which the heat will be thrown.

When completed, the equipment has a compact, attractive appearance. However, if the contractor expects that the resulting operation of this assembly will match the data he selected from the coil, fan and motor tables, he is due for a surprise.

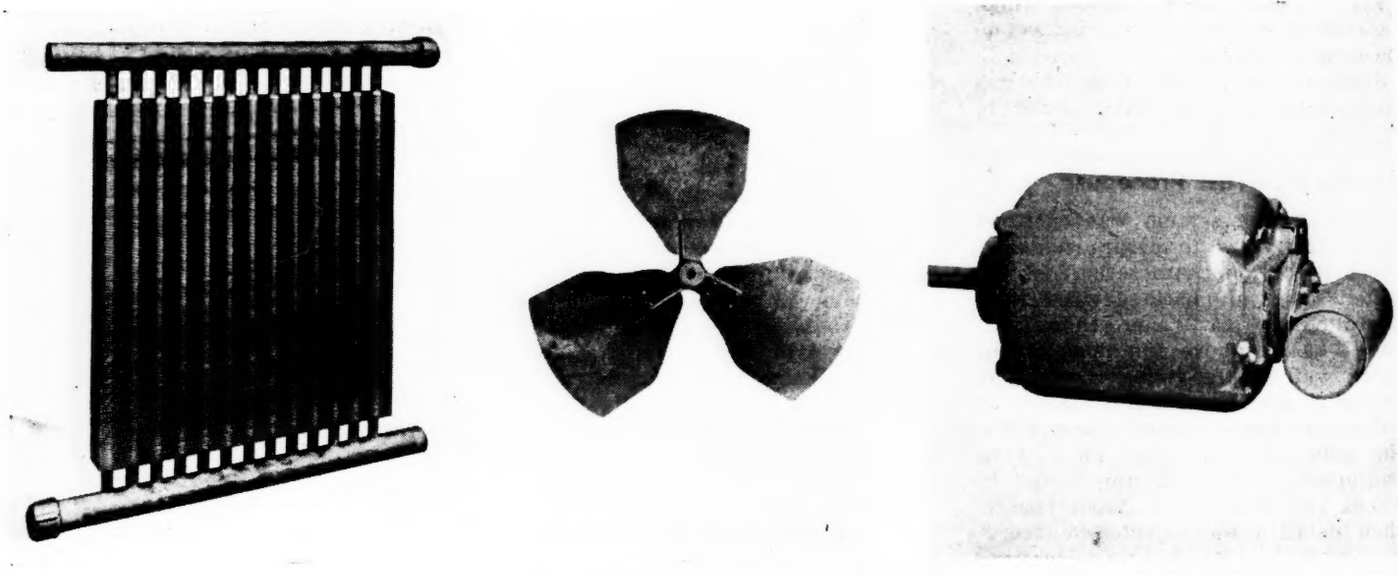
First, consider the coil performance. Data in the coil table were obtained from a test setup in which all of the air entered and left the coil in a direction at right angles to the coil face.

As used in the garage setup of Fig. 4 and 5, the fan will deliver air to the coil in a spinning stream. Air velocities relative to the coil surfaces are different from those during laboratory tests. The air particles strike the coil fins, in the garage, in much the same manner as air flowing through a duct hits a partially-closed, multi-leaf damper. The installed coil resistance is therefore apt to be abnormally high.

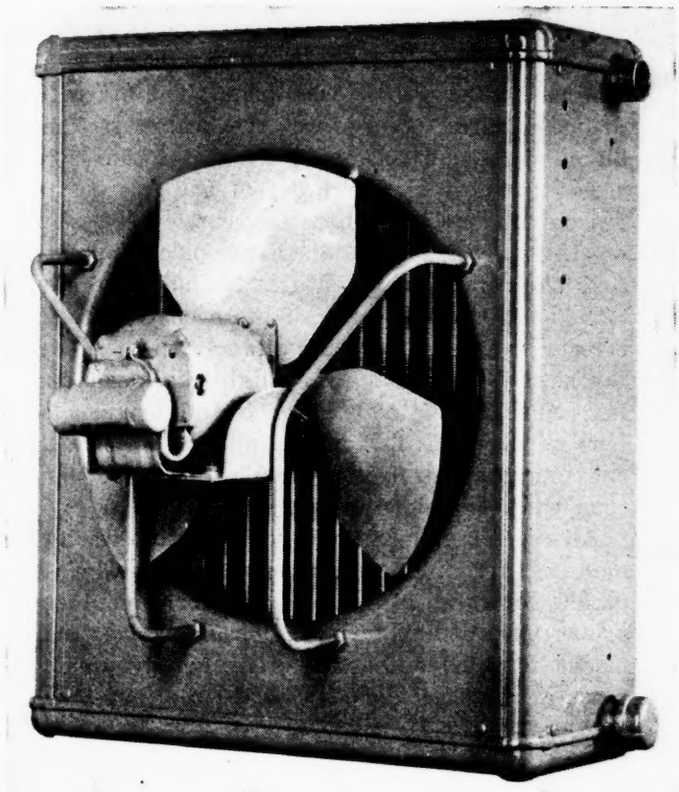
It may be a fact that the spinning air "wipes off" more heat than does a straight-through air flow. The main point here emphasized is that the installed conditions cannot be exactly predicted from the tables since the application conditions do not duplicate the conditions under which the catalog data were obtained.

Now as to the fan. The table data were obtained as prescribed in Bulletin No. 103 of the National Association of Fan Manufacturers which covers "Standard Test Code for Centrifugal and Axial Fans." Here, the axial flow fan tests are classified as follows:

(1) Axial blowers of exhausters without ducts.
(2) Axial blowers in ducts.
(3) Axial exhausters in ducts.



(Left to right) Fig. 1, 2, and 3. Coil, fan wheel, and motor, respectively, selected from catalog data to make up the unit heater shown in Fig. 4 and 5.



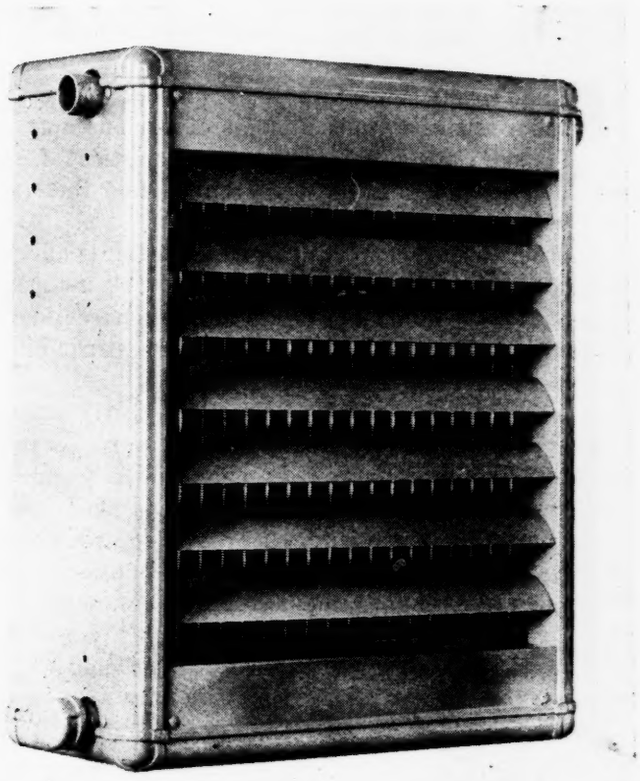


Fig. 4 and 5. Front and back views of completed unit heater.

None of the corresponding three code setups covers the garage hookup, on which the coil and fan are located extremely close to each other. The fan performance will, then, be different in the garage than when it was being tested for table ratings on a code setup. Further, since the fan operates differently, its horsepower and rpm will, barring coincidence, be different from the values selected.

This being the case, the motor will operate at other speed and horsepower values than those originally selected from the motor catalog.

We thus have another case where the manufacturer should not be blamed. In fact, had the manufacturer been consulted, he would have drawn the contractor's attention to still another section of the general catalog covering a unit complete with coil, fan, motor, cabinet, inlet flare and louvers. This complete assembly would be listed under the heading "Speed Heater." In the catalog would be found the contractor's complete required conditions which he could expect to attain since the unit's rating is based upon its being tested "as a whole" as prescribed in the Heater Test Code.

Moreover, since such units are manufactured on a mass production assembly line basis, it is questionable whether the contractor saved money by fabricating his own tailor-made cabinet, louvers and inlet flare.

This interdependence of the various elements of a system can greatly mislead those who assemble such a complicated combination as a complete air conditioning unit.

Since practically every heating and ventilating job includes at least one fan, it would be well to emphasize one point. Lack of realization of the extent of the above-mentioned interdependence has been the source of too frequent dispute between fan-user and fan-manufacturer. In an endeavor to eliminate such controversy, a group of very capable engineers was given the task of devising a common yardstick or code covering testing fans in the field to determine whether the installed fan succeeds or fails to meet its guarantee.

Field Test of Fans

Note the "Supplement No. A to Bulletin No. 103 of July 1940." It is quoted in part, for the benefit of those who may not have a copy handy:

"(1) Research undertaken by the Members of the National Association of Fan Manufacturers in cooperation with Test Code Committees of the Engineering Societies reveals thus far that no accurate or practical methods of testing fans in the field has been developed either by means of gas analysis or by use of Pitot tube.

"(2) Since the values obtained from field tests vary so widely from actual test results, guarantees of the performance of fans can only be made from laboratory tests conducted by the manufacturer in accordance with the 'Standard Test Code for Centrifugal And Axial Fan' approved jointly by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers, with cooperation from Committee No. 10 of the Power Test Code Committeee of the American Society of Mechanical Engineers."

This is not an alibi convenience of fan manufacturers. It is merely stating the facts as they stand. On the other hand, a reliable fan manufacturer knows that seldom are actual installation conditions such as to permit duplication of code setup with its long straight

duct, etc. His duty is to assist customers to economically alter existing installation and plan future ones so that the installed performances agree as closely as is possible to the laboratory performances.

So much, then, as to the effects of various duct connections on the aerodynamic characteristics of fans. Specific case histories of such troubles and their solutions will appear in subsequent articles.

Another field of complaint in which a fan is allegedly at fault is the case, usually of a ductwork under suction, of a fan performing on its normal characteristics curves yet not moving sufficient volume through the customer's intended system or process.

In other instances where mechanical vibration is present throughout the entire system, many users are too willing to jump to the conclusion that the vibration is the cause rather than an effect of the phenomenon.

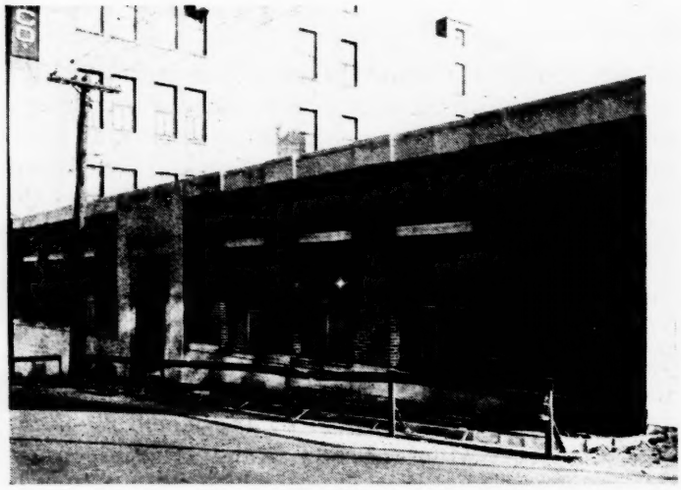
Air pulsations frequently occur in a specific element of a system. Since this pulsation does not occur when the fan is idle, it does not necessarily follow that the fan in operation moving the air through the pulsating element is, therefore, to blame for the element's pulsation.

This is no truer than the following: A garden hose produces a perfectly streamlined flow through the attached well-designed nozzle. The stream is directed against the head of a bass drum. The air within the drum pulsates. Therefore, the water stream is to blame since shutting off of the water causes the pulsation to subside. For proof of the falseness of this reasoning, direct the nozzle stream into a slowly expanding, well-machined discharge piece, the nozzle and expansion forming a Venturi. No pulsation occurs.

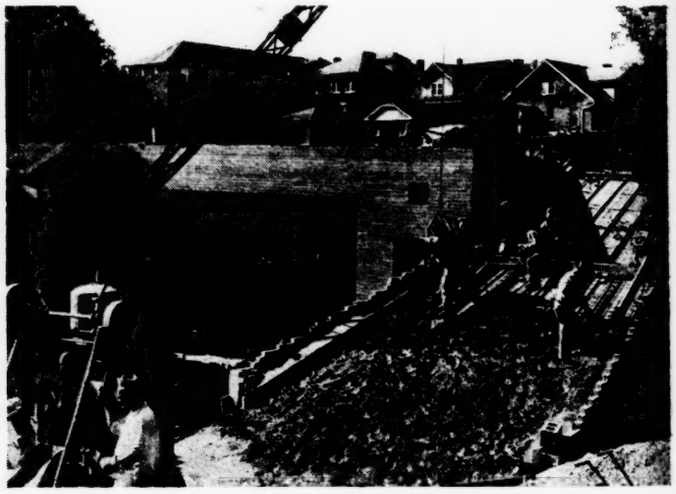
Noise is another cause of the accusing finger being directed toward an innocent fan. Let a well-designed fan supply air through a straight discharge duct having relatively low resistance. Nothing unusual occurs. Now replace this duct with a pipe of proper detail for one note of a pipe organ. Should the fan be blamed for the sound emitted from the system?

All the foregoing is not given to whitewash the fan manufacturer. He will readily accept all just complaints in cases of mechanical vibration due to improper shop or field balance, or collar knocks and other mechanical defects or inherent aerodynamic discrepancies which accidentally escape the inspector.

Three Snow Melting Jobs

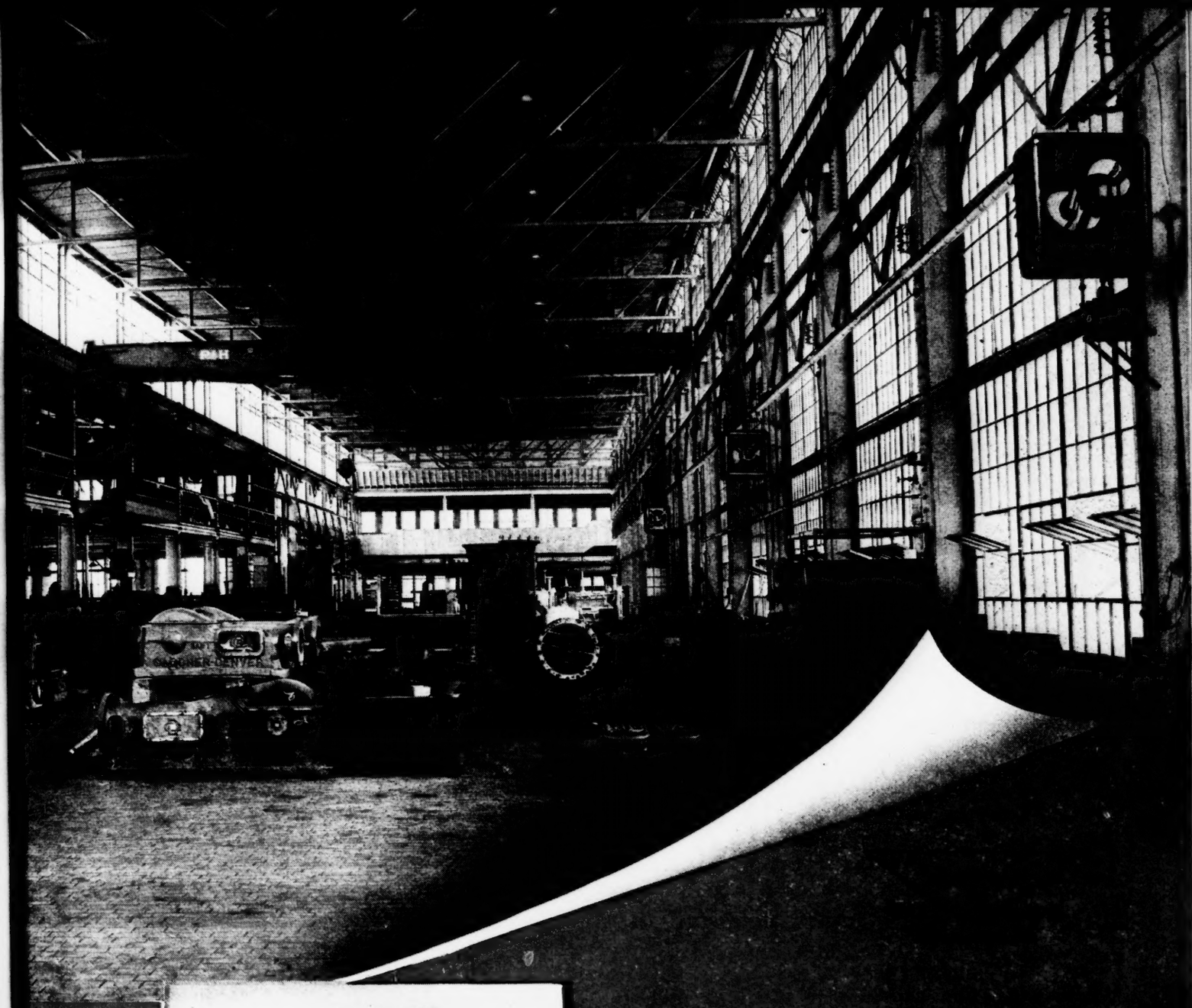


This view of the Heekin Can Company's new office building shows location of the sidewalk, which will be kept clear of ice and snow by a system of pipe coils, embedded in the concrete and carrying steam to maintain the temperature.

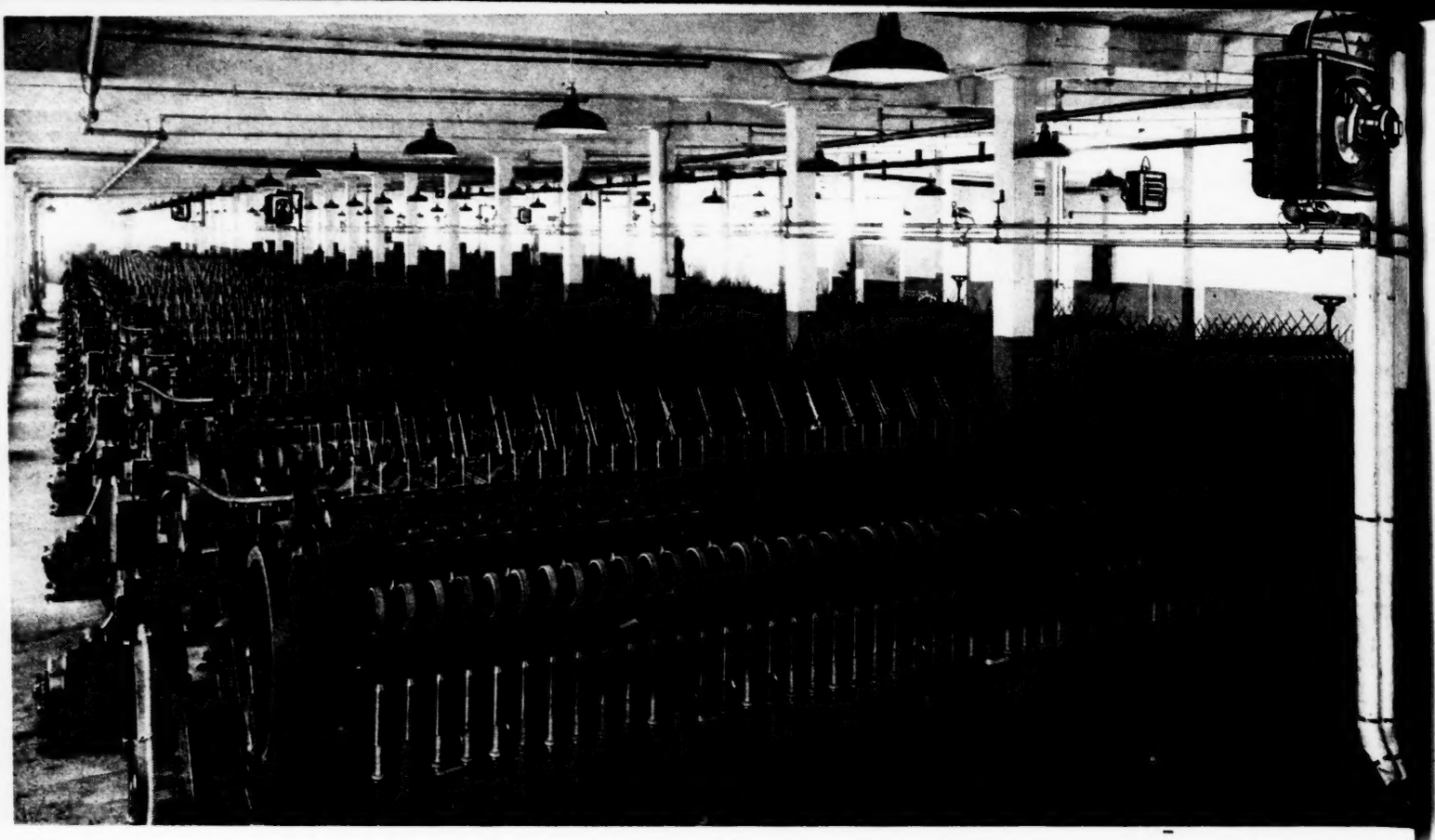


Photograph of the partially completed ramp of the new Chrysler-Plymouth Garage in Beckley, West Virginia, shows details of the grid-type pipe coils for the snow-melting system that will keep the ramp "navigable" in the winter.

A view of the pipe coils for the snow-melting system in the driveway of the Bowmar Motor Company garage and office building, Hingham, Mass. The pipe coils were fabricated and positioned, then the concrete was poured over the system, which is to be supplied with water from the same boiler that is used in the building heating system. Photos by A. M. Byers.



When
When Not
and How



High Pressure Steam with Unit Heaters

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When, when not, and how to use high pressure steam is a problem frequently met where steam for heating is supplied from a central boiler plant. This article is presented to help the engineer design the heating system where high pressure steam is available.

ESPECIALLY in industrial plants, the source of steam for heating purposes is often a central boiler plant where high pressure is carried for process work or power generation. In such cases, many plant engineers realize the desirability of reducing the pressure of the steam used for space heating purposes so that the heating system may operate at low pressure; others wish to use high pressure steam to supply the unit heaters.

Disadvantages of High Pressure with Unit Heaters

This article reviews the problem involved in the use of high pressure steam with unit heaters, and is presented to assist the engineer properly to design the heating system where high pressure steam is available. Although most unit heaters are designed for use on steam pressure up to 125 lb, it is neither desirable nor economical to use high pressure steam for space heating purposes whether it be used in radiators, pipe coils, panels or in unit heaters. If steam at 100 or 125 lb pressure is used in pipe coils, anyone touching the coils or the pipes supplying them would be badly burned, for the temperature of the surface is between 300F and 350F.

While suspended unit heaters are generally located high enough so that direct contact with the hot surfaces is avoided, nevertheless a similar hazard is still present. For example, when operating at 60F entering air temperature with 125 lb steam, the unit heater outlet air temperature is between 160 and 170F, and with only 75 lb steam the outlet temperature is 150F. With these temperatures, two difficulties arise: (1) if the unit heater is mounted at a low level, the high temperature air blast will be most objectionable to the occupants, and (2) since there is such a great difference in temperature between the air from the unit heater and the average air temperature in the building, it is difficult to difluse the air within the space, and especially to project it downward. If the heated air does get down it rises before it has time to heat the working level, and only serves to overheat the ceiling where it is wasted.

Due to this waste, experience indicates that although the heat output of a unit heater is increased 45 to 50% when the steam pressure is increased from 15 to 100 lb, the actual heating effect at the working level is no greater than the capacity of that heater at 15 lb pres-

sure. Consequently, where working steam pressure is in excess of 15 lb, it is recommended that in selecting heaters the capacity at 15 lb pressure is that which should be used. In figuring fuel consumption and main and trap sizes, however, the full capacity of the unit at the actual working pressure must be used. The difference is simply wasted.

That the use of high pressure steam is wasteful and otherwise objectionable is supported by the observation of those close to operating problems. The following is paraphrased from letters received from an insurance association:

"Hitherto our experience has been that when comparatively low pressures of steam, such as 15 lb, were used in unit heaters, a few 212F sprinklers were generally necessary immediately over the heater and within about 20 ft over the line of air delivery when the heaters were near the ceiling.

"Now, however, we find instances where steam pressures as high as 100 lb are used; in one of these we recently had a sprinkler leakage loss, due to the fact that the 212F sprinklers near these heaters opened on account of excess temperature. In this particular mill a number of the higher degree sprinklers have been put in, namely, 286 and 360F heads, and we do not like to see this done, as the heads are slower to open than the usual type of sprinklers and, therefore, the protection is not as good.

"Will you inform us whether it seems to be the modern tendency to use such pressures as 100 lb, for instance, in unit heaters or whether pressures of around 15 lb or so are still used in the majority of cases."

In response to the reply to the foregoing letter the following further comments were received:

"Thank you for your letter. It is interesting to note that the use of high pressure steam is not advocated by you, as pressures not over 15 lb are best for satisfactory heating.

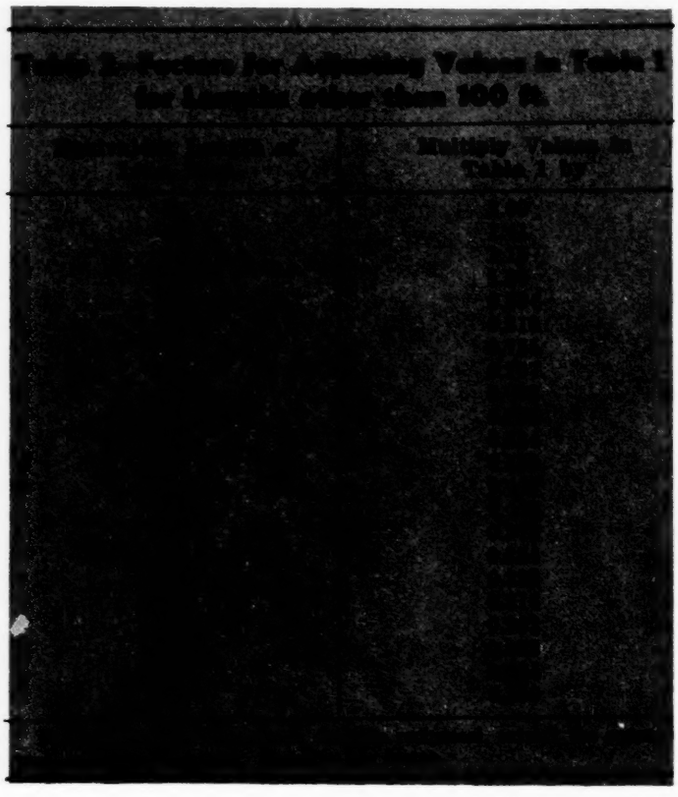
"It appears, therefore, that the unit heater manufacturers and the fire insurance companies, for different reasons, are both opposed to the use of high temperature steam."

Where it is necessary to mount the unit heaters high above crane rails and machinery, vertical shaft or down blow unit heaters are frequently selected; it is essential that such heaters be so designed, installed, and operated as to get the air down from these high levels to the working area. Some manufacturers, including the author's company, provide low temperature heating sections in vertical shaft units to compensate, in some measure at least, for the use of high pressure steam. However, when fans are idle (which in mild weather may be a good portion of the time), the air flowing by gravity over high temperature sections filled with high pressure steam is heated much hotter than it would be by gravity flow over a low pressure section, and this results in unnecessary over-heating in spaces above the heaters with consequent waste. These are added reasons for recommending low pressure steam or vertical shaft unit heaters.

Another disadvantage of high pressure is that the life expectancy of many unit heaters has been found to be only about half as much at a working pressure of 100 lb as when it is operating at low pressure.

Table 1 – Pipe Sizing Table for Steam Mains
(In terms of square feet of direct radiator surface served)

Pressure Drop, Oz. Per 100 Ft.	Pipe Diameter, Inches													
	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12
	Square Feet Direct Steam Radiator Surface													
¼	14.0	28.4	63.8	92.2	195	326	596	892	1,256	2,324	3,816	7,952	14,436	23,245
½	19.2	40.4	88.8	138	275	460	840	1,260	1,776	3,288	5,396	11,240	20,468	32,964
¾	20.0	49.2	109	168	337	564	1,028	1,540	2,176	4,020	6,600	13,752	25,044	40,294
1	28.0	56.8	126	194	390	652	1,188	1,780	2,516	4,648	7,636	15,904	28,964	46,626
1½	34.4	69.6	154	238	476	800	1,456	2,180	3,084	5,700	9,356	19,492	35,496	56,994
2	38.4	78.0	173	267	536	892	1,632	2,444	3,452	6,380	10,476	21,824	39,740	63,864
3	48.8	98.8	218	337	676	968	2,060	3,234	4,360	8,060	13,232	27,564	49,832	80,584
4	56.0	114	251	388	776	1,300	2,376	3,552	5,020	9,280	15,240	31,748	57,816	92,880
5	62.8	127	141	436	872	1,456	2,660	3,980	5,628	10,400	17,080	34,776	64,744	104,068
6	68.8	139	308	476	952	1,592	2,912	4,356	6,156	11,380	18,688	38,924	70,880	113,964
7	74.4	151	333	516	1,028	1,724	3,148	4,712	6,656	12,304	20,208	42,092	76,652	123,160
8	79.2	161	355	548	1,100	1,840	3,360	5,024	7,100	13,128	21,556	44,904	81,768	131,376
9	84.4	171	378	580	1,168	1,952	3,568	5,340	7,544	13,948	22,904	47,716	86,884	139,592
10	88.8	180	398	616	1,228	2,056	3,756	7,025	7,944	14,684	24,112	50,224	91,440	146,932
12	97.2	197	436	672	1,348	2,252	4,116	6,156	8,700	16,080	26,408	55,008	100,188	160,916
14	105	213	472	728	1,456	2,436	4,448	6,660	9,408	17,392	28,560	59,492	112,328	174,048
16	112	226	500	772	1,548	2,588	4,732	7,080	10,004	18,492	30,368	63,280	115,196	184,940
18	119	242	536	824	1,652	2,764	5,048	7,556	10,676	19,726	32,408	67,504	122,924	197,348
20	126	255	564	872	1,744	2,912	5,320	7,964	11,252	20,800	34,156	71,152	129,568	208,012
25	140	285	628	972	1,948	3,256	5,948	8,900	12,576	24,156	35,176	79,524	144,812	232,484
30	153	310	688	1,060	2,124	3,548	6,484	9,704	13,712	25,347	41,620	86,700	157,876	253,488
40	178	362	796	1,228	2,460	4,112	7,512	11,244	15,888	29,368	48,234	100,452	183,000	293,804
50	212	440	966	1,508	3,016	5,044	9,212	13,788	19,480	36,008	55,132	121,172	194,388	360,696
60	251	508	1,128	2,176	3,508	5,828	10,644	15,928	22,504	41,604	68,316	142,304	259,128	416,024
100	281	568	1,260	1,946	3,896	6,512	11,896	17,800	25,136	46,496	76,252	158,848	289,420	464,948
125	306	620	1,380	2,128	4,260	7,124	13,012	19,472	27,516	50,868	83,528	174,004	316,948	508,984
150	328	708	1,582	2,456	4,920	8,224	15,024	22,484	31,772	58,732	96,442	200,980	366,108	587,824



Studies of corrosion in steam heating systems have shown that use of high pressure steam is responsible for much of the corrosion of unit heater sections. In some cases this may be due to original presence of elements in the water that in themselves prove corrosive to copper and copper alloys, but in many operations quantities of oxygen and carbon dioxide are liberated by the breaking down of carbonates which occurs in steam generation at high pressures. Since most chemical reactions are greatly accelerated by increase in temperature, the presence of oxygen and carbon dioxide in substantial quantities is likely to prove very serious from a corrosive standpoint in the presence of high pressure-high temperature steam when the gas dissolves in the condensate to form an acid condition.

Disadvantages of high pressure steam with unit heaters can be summarized, then, as follows:

(1) A unit heater, regardless of make or type of construction, can be expected to last twice as long on low pressure as on high pressure steam; (2) use of high pressure steam accelerates corrosion; (3) there is the ever-present hazard of seriously burning occupants or damaging stock in case of a break in the high pressure heating main or release of sprinkler system head, and (4) the cost of high pressure fittings and traps is greater than the cost of low pressure accessories and, as with the unit heater itself, maintenance cost may be expected to be higher.

Therefore, when high pressure steam is available it should be reduced to low pressure for heating purposes; this can be done at little if any increase in first cost by proper sizing of the piping and with a consequent great year-after-year saving in fuel costs.

Where High Pressure is Justified

There are some places where the use of high pressure steam in unit heaters is desirable, such as applications where high temperature air may be required for drying or for furthering a process.

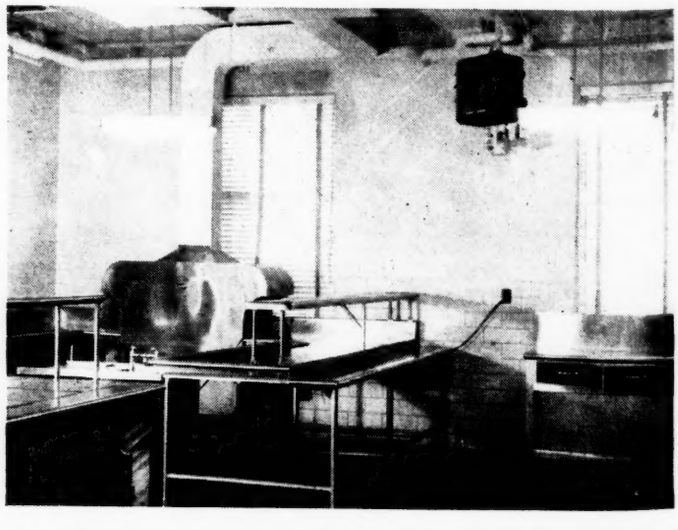
Where unit heaters are used with high pressure steam for drying or other process service the heaters with motors attached should not be installed within the dry rooms or other locations where the temperature may exceed 100F; because motors supplied with unit heaters are not suitable for use in high temperature air.

There are cases such as in laundries and creameries where only one or two unit heaters are needed. Here the added cost of reducing the steam pressure may offset the disadvantages of high pressure steam, and high pressure may thus be more economical. It is more or less general practice on such installations to operate such jobs at high pressure only when steam is being drawn for process work and to drop the pressure to 5 or 10 lb when steam is being used for heating only. If this is the case, it is important that the piping be sized as for a low pressure system and that traps suitable for high pressure be used but sized so that the orifices are large enough to pass the condensate at low pressure.

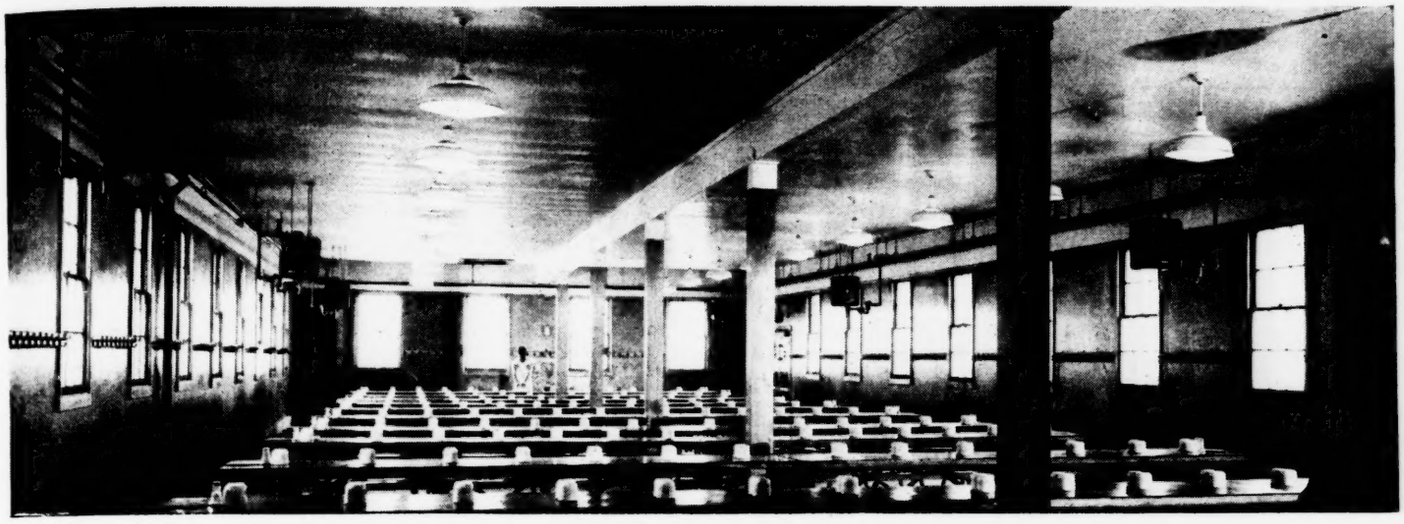
The Question of Pipe Sizes

In most cases the reason high pressure steam is selected for space heating is because of the belief that the piping system can be made smaller and will cost much less. When due consideration is given to all factors, however, this does not prove to be a sound premise. The conventional low pressure steam heating system has mains, branches, and risers designed on the basis of somewhere in the neighborhood of ¼ lb drop in pressure. Such a system has comparatively large pipe sizes as compared to a high pressure system. Where high initial pressure is available, however, the low pressure system can be designed for a large pressure drop, resulting in pipe sizes but little in excess of the sizes that would normally be used on an equivalent high pressure system.

Table 1 is a tabular solution of Babcock's formula for flow of steam through pipes with the flow expressed in square feet of radiator served. The data are suitable for sizing all dripped horizontal steam



Serving room, Valentine Hall, Amherst College



Mess hall, Naval Training School, Great Lakes, Chicago, Ill.

mains and branches, and down feed risers. They are not recommended for lines where the condensation flows opposite to the steam flow. The figures given in Table 1 are based on an initial pressure of 2 lb per sq in. gage and a length of line of 100 ft. The length of pipe in any given case is the run in feet plus the equivalent length of valves and fittings given in Table 4.

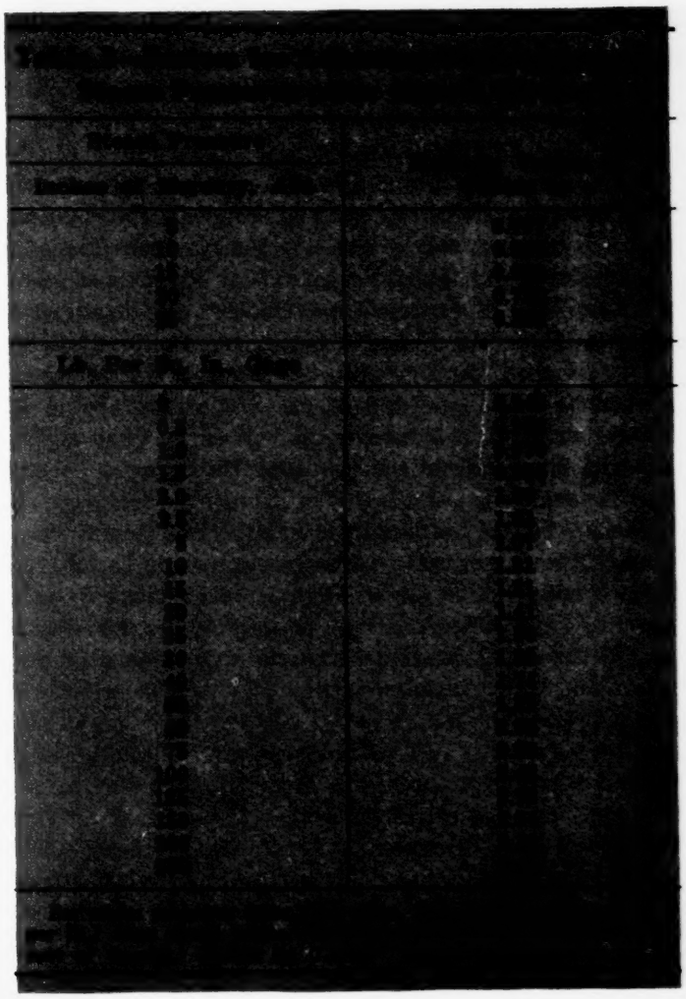
Where the initial pressure is from a high pressure system, it is entirely practical to design the low pressure distributing system on the basis of carrying an initial pressure of 15 lb at the outlet of the reducing valve and designing the piping system for a pressure drop of 10 lb so that there will still be available a pressure of 5 lb at the end of the piping system. It is, in fact, even practical to permit a pressure drop of 12 to 13 lb on the low pressure system and still have 2 to 3 lb at the last unit.

In the design of a heating system, the load is taken off at several different points, so that corrections must be made accordingly. There are two types of steam main designs. One provides for the same size main from first to last branch; the other provides for a reduction of the main size as the load is taken off. There is generally little difference in the total cost. Some engineers prefer one type, some the other.

It has been the practice of the writer's company to use the same size main from its origin to the last branch. This results in a minimum difference in pressure between the first and last branches. This practice, which has proved satisfactory through many years, involves corrections (as in Table 5) in the total connected load to arrive at the average load on which the pressure loss for a non-reducing main should be sized.

Subsequent examples show (1) the size of supply main required for a group of unit heaters served by a low pressure boiler based on a 2 lb working pressure and ¼ lb pressure drop in the system, and (2) examples showing the reductions that can be made in the supply piping system by using 15 lb initial pressure through a reducing valve from a high pressure system and 10 lb pressure drop in the low pressure system. These examples and tables refer only to sizing supply mains. Usual methods of sizing return mains should be used. Returns on any reduced pressure should be drained to an open vented receiver.

In each case for direct comparison we will assume the load is to be four horizontal shaft unit heaters, each 1458 sq ft EDR, or 5832 sq ft total. Assume these units to be equally spaced on a main 200 ft long (not including correction for fittings) between boiler or reducing valve and the branch to last unit. Assume the first section contains a gate valve and the branch tee and each succeeding section a 90° ell and the branch tree.



Valves or Fittings	Nominal Diameter of Pipe, Inches																		
	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16
	Equivalent Length Straight Pipe, Feet																		
Gate valve			.37	.44	.55	.65	.90	1.00	1.20	1.40	1.60	1.80	2.20	2.60	3.30	4.00	4.80	5.60	6.50
Angle valve	1.8	2.3	3.0	4.1	5.2	6.3	7.5	9.0	10.5	12.0	13.5	15.0	18.0	21.0	27.0	33.0	39.0	45.0	52.0
Swing check valve	3.5	4.5	6.0	8.1	10.5	12.5	15.0	18.0	21.0	24.0	27.0	30.0	36.0	42.0	54.0	66.0	78.0	90.0	104.0
Globe valve, open	8.0	10.0	13.0	17.0	22.0	28.0	34.0	40.0	48.0	56.0	64.0	72.0	88.0	104.0	136.0	168.0	204.0	240.0	280.0
Globe valve, ¼ closed	1.8	2.3	3.0	4.1	5.2	6.3	7.5	9.0	10.5	12.0	13.5	15.0	18.0	21.0	27.0	33.0	39.0	45.0	52.0
Globe valve, ½ closed	3.5	4.5	6.0	8.1	10.5	12.5	15.0	18.0	21.0	24.0	27.0	30.0	36.0	42.0	54.0	66.0	78.0	90.0	104.0
Globe valve, ¾ closed	8.0	10.0	13.0	17.0	22.0	28.0	34.0	40.0	48.0	56.0	64.0	72.0	88.0	104.0	136.0	168.0	204.0	240.0	280.0
Tee	1.8	2.3	3.0	4.1	5.2	6.3	7.5	9.0	10.5	12.0	13.5	15.0	18.0	21.0	27.0	33.0	39.0	45.0	52.0
Elbow, standard	1.0	1.2	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	10.0	12.0	15.0	18.0	21.0	24.0	28.0
Elbow, medium sweep	0.7	0.9	1.2	1.6	2.0	2.4	2.8	3.2	4.0	4.8	5.6	6.4	8.0	9.6	12.0	14.4	16.8	19.2	22.4
Elbow, long sweep	0.5	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.8	3.4	4.0	4.6	5.7	6.9	8.6	10.3	12.0	13.8	16.0
Elbow, square	2.0	2.5	3.4	4.6	5.8	7.0	8.1	9.3	11.6	13.9	16.2	18.5	23.1	27.8	34.7	41.6	48.6	55.5	64.0
45° elbow	0.4	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.3	2.7	3.2	3.7	4.6	5.5	6.9	8.3	9.7	11.1	12.8

Note—Values for closed (180°) return bends, approximately between values for square elbow and check valve. Values for entrance into pipe (as from tank) approximately between 45° ell and long sweep elbow. Values for run through a tee, same as long sweep elbow. Values for run outside outlet of tee, same as for tee.

It is necessary to add to the net length the equivalent length of valves and fittings to determine the effective length to arrive at the proper multiplier to use from Table 2.

It is common practice where the system is made up of the average size direct radiation or convectors to double the net length to arrive at the equivalent length for test selection. But where the load is taken off in a few large units as for unit heaters it is generally sufficient to add 50 to 75% for fittings.

Single Size Mains

Example 1. For the single size main, 2 lb pressure, ¼ lb pressure drop. Equivalent length, after adding 75% is (200 + 75% × 200) = 350 ft. From Table 2, opposite 350 find multiplier of 0.534. Connected load, given as 5832. There are 4 unit heaters on 4 branches; refer to Table 5 and find a correction factor of 65% for 4 branches. 5832 × .65 = 3791 sq ft which when divided by 0.534 = 7099 sq ft. Since from Table 1, for a 4 oz drop, a 5 inch main will carry 9280 sq ft, this size is well over the required 7099, and a 5-inch main is selected.

Check. The actual length is 200 ft. For 5-inch pipe, from Table 4, one gate valve is equivalent to 2.9 ft; three 5 inch ells to (3 × 13) = 39 ft; four 5 inch tees to (4 × 27) = 108 ft. Total 200 + 2.9 + 39 + 108 = 349.9 ft. Since this is almost exactly the equivalent length assumed (350 Ft), the selection of 5 in. is correct.

Example 2. A 15 lb initial pressure with 10 lb drop, single size main. Corrections must be made for length (Table 2) and for initial pressure (Table 3). For trial assume a 350 ft equivalent length. The factor for 350 ft from Table 2 is 0.534. Factor for 15 lb initial pressure from Table 3 is 1.31. From previous examples, connected load equivalent is 3791 sq ft. Then 3791 ÷ .534 ÷ 1.31 = 5411 sq ft.

From Table 1 find, for a 10 lb pressure drop (160 oz.), that a 2 inch main has a capacity of 4920 sq ft. This does not quite equal the test requirement of 5411 but since we are dealing with much smaller pipe sizes it is probable that the equivalent length of the fittings will not equal the 150 ft allowed for them and that we will have a more favorable factor from Table 2. Consequently, select tentatively the 2 inch pipe and check.

Check. Actual length = 200 ft. One 2-in. gate valve (Table 4), 1.2 ft. Four 2-in. tees, 48 ft. Three 2-in. ells, 15.9 ft. Total 200 + 1.2 + 48 + 15.9 = 265.1 ft. Factor for this length, Table 2, is approximately .615, so that 4920 × .615 × 1.31 = 3964 sq ft, ample for the 3891 sq ft load.

Pause now to see the result of these calculations. For the steam mains sized for a single size main throughout, we require a 5-in. main for the low pressure, but only 2 in. for the high pressure. The difference in cost, ease of erection, and space occupied between these two sizes is obviously one of importance.

Reducing Mains

For the reducing mains there will be no correction of the load for the number of branches but there will be a separate problem for each section. Because of the comparatively large load at each branch, we will assume for this example that we can probably reduce the main size at each branch to unit heater. Also each section will be approximately 50 ft long, the first section has the gate valve and the second, third and fourth each have one of the ells. Each will have one of the four tees. But all the fittings will be figured in total length of the main. For figuring the equivalent length of fittings it will for test purposes be safe to figure that they will average one size smaller than the first section.

Example 3. Reducing main, 2 lb pressure, 4 ounce drop. Load for sizing section is 5832 sq ft. Assume

equivalent length is 350 ft [200 + (200 × .75)]. Correction from Table 2 is 0.534, and 5832 ÷ .534 = 10,921 sq ft. This is in excess of the capacity of the 5-in. pipe, Table 1, so that the first section will be 6-in. pipe.

The next section carries 4375 sq ft or 8191 sq ft equivalent when corrected. This is within the capacity of the 5-in. pipe (9280 sq ft in Table 1) so that the second section will be 5-in. pipe.

Now check the equivalent length to see if our addition of 75% for fittings may be far enough out of line to cause enough error to change sizes. Assume now that the average size will be 5 in.

1	5-in. gate valve	= 2.9 ft
3	5-in. ells	= 39
4	5-in. tees	= 108
		149.9 ft

The assumed addition of 150 ft for fittings was thus almost exactly correct.

Table 3—Factors for Correcting Load in Sizing Non-Reducing Mains

No. of Branches	Per-cent of Load to be Used
1	100%
2	80%
3	70%
4 to 10	65%
Over 10	60%

Similarly, it will be found that the third section, carrying 2916 sq ft, has an equivalent load of 5461 sq ft. The capacity of 4-in. pipe at a 4-ounce drop, Table 1, is 5020 sq ft, and it will be safe to use this size because there was sufficient surplus in the first section to more than offset this small shortage so it will be satisfactory to use the 4-in. pipe.

The final section, carrying 1458 sq ft, is found by the same method to require a 3½-in. pipe.

Example 4. Reducing main, 15 lb initial pressure and 10 lb drop. The load on first section is 5832 sq ft. Assumed equivalent length 300 ft, factor from Table 2 is .575 (since the higher initial pressure and larger pressure drop reduces the size, the addition for fittings should run near 50% rather than 75%), 5832 ÷ .575 ÷ 1.31 (from Table 3, 15 lb initial pressure) = 7742 sq ft. From Table 1, (10 lb drop) the 2½-in. pipe is found to have a capacity of 8224 sq ft, so that 2½ in. is satisfactory for the first section. The fittings, as indicated in Example 3, should average one size smaller.

Check. Equivalent total length: 200 ft + 1.4 ft (one 2-in. gate valve) + 48 ft (4 2-in. tees) + 15.6 ft (3 2-in. ells) = 264.8. Since this is less than the assumed length of 300 ft, the selection of 2½-in. is correct for the first section.

The load on the second section is 4374 sq ft which, when divided by .616 (the approximate factor for 264.8 ft Table 2) and by 1.31 equals 5408 sq ft. Since this exceeds the capacity of the 2-in. main (4920 sq ft for 160 oz drop, Table 1), and since we have but little surplus in the first section, it will be necessary to continue 2½-in. pipe to the second unit.

The load on the third section is 2916 sq ft. 2916 ÷ .616 ÷ 1.31 = 3613 sq ft. This calls for a 2-in. main.

The load on the last section is 1458 sq ft, and 1458 ÷ .616 ÷ 1.31 = 1806 sq ft. This requires (Table 1) a 1½-in. main.

Pipe Sizing Summary

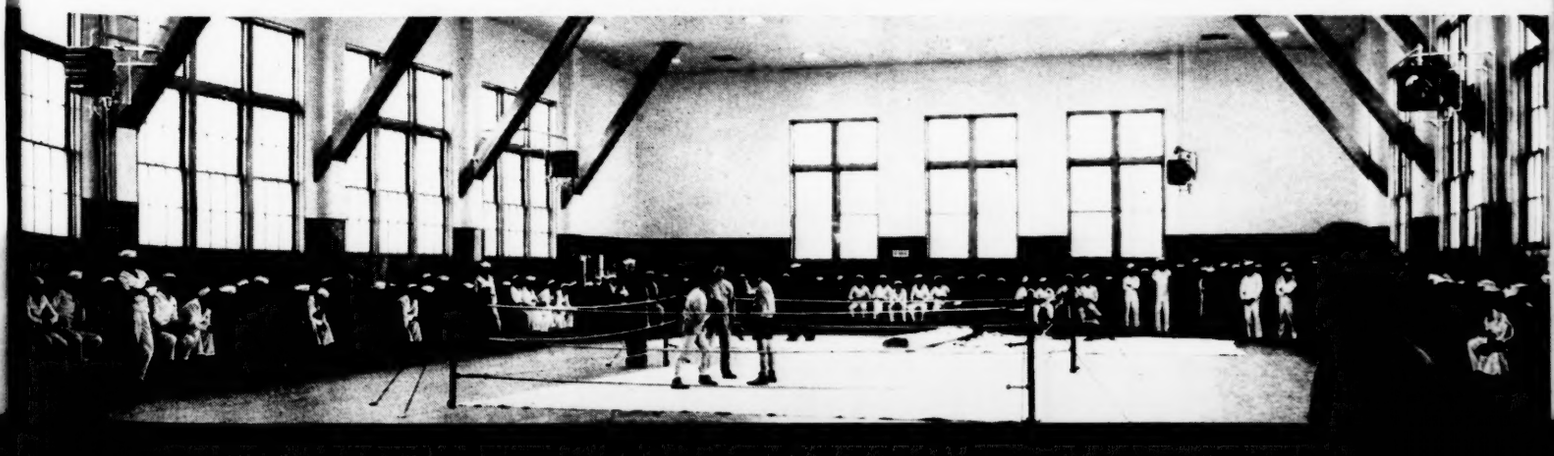
The results of the pipe sizing analysis can now be tabulated so as better to compare the results:

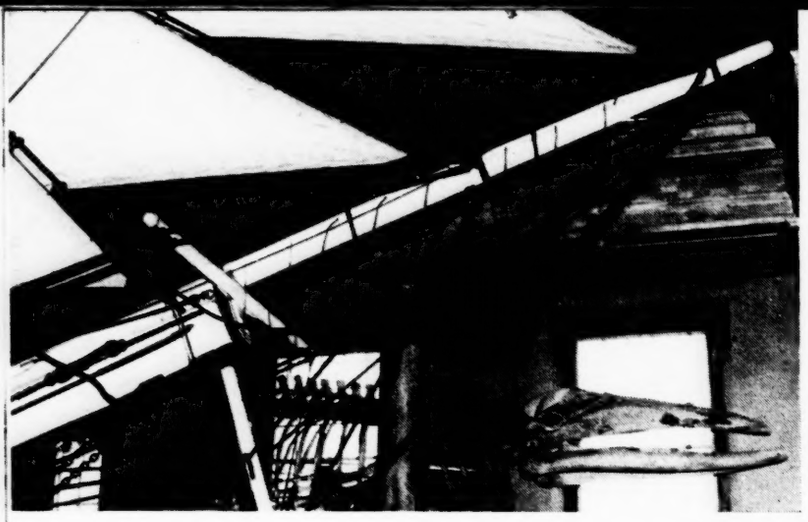
Steam Pressure and Pressure Drop	Type of Main	Section 1	2	3	4
		Pipe Dia., Inches			
Low	Single size	5	5	5	5
High	Single size	2	2	2	2
Low	Reducing	6	5	4	3½
High	Reducing	2½	2	1½	1¼

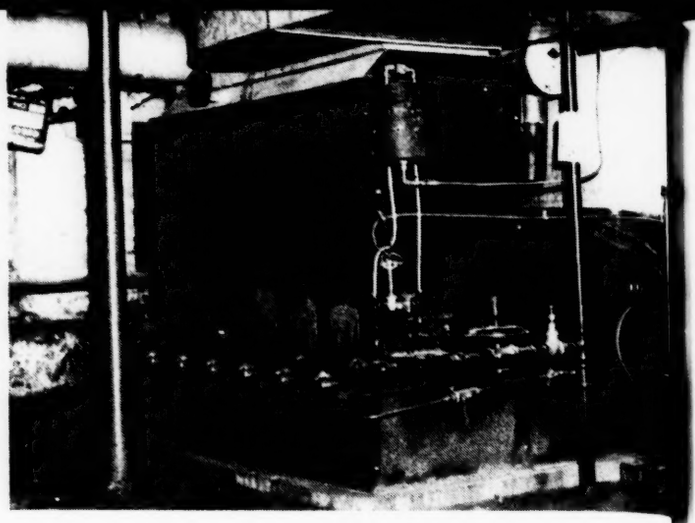
It will be noted in comparing Example 1 with Example 3 and Example 2 with Example 4 that it will make little difference in pipe, fitting and labor cost whether the main is a single size main or reducing where the take-off of the load is evenly distributed, as in these examples. It is probable that if the load was much heavier on the first part of the system than toward the end the reducing main would prove to be the less costly, while if most of the load were concentrated on the end farthest from the source of supply the reverse would be true.

Now the question may arise as to what size mains would result from applying these formulas to the design of a high pressure system. Obviously, it would result in even smaller mains than Examples 2 and 4. First the correction factor for initial pressure, Table 3, becomes 2.48 for 100 lb as compared to 1.31 for 15 lb initial pressure. It has not been general practice, however, to design high pressure heating piping as small as would result from the use of these formulas. Such systems are generally designed more nearly the size arrived at in Examples 2 and 4, probably so that the piping will be large enough to supply these units if pressure is dropped below the design pressure.

But even if the system were designed for smaller piping, as by use of these formulas, the added cost of high pressure traps and fittings would largely offset any saving in piping, to say nothing of the loss of all the advantages of low pressure steam for space heating.

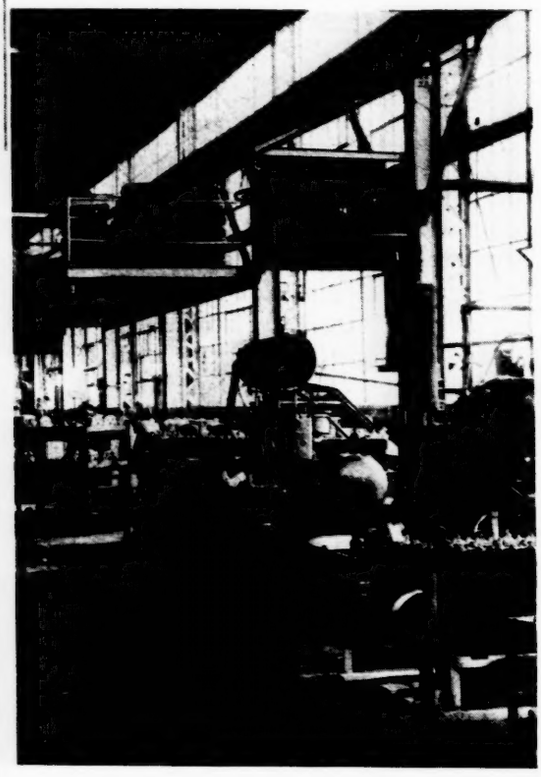




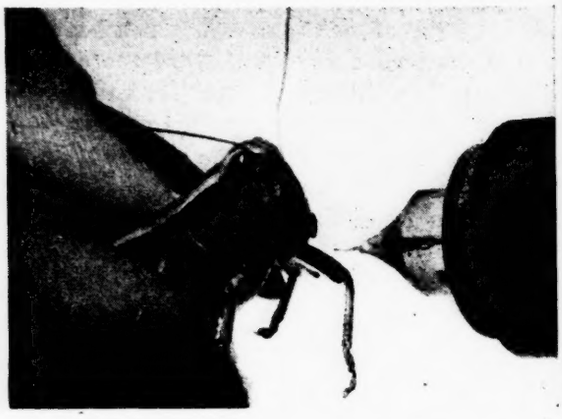


Citizens of New Bedford, Mass., center of the old New England whaling industry, formed the Old Dartmouth Historical Society and founded the Bourne Whaling Museum. Here they collected ship's gear, whaling instruments, and the logs of hundreds of voyages to the whaling grounds of the arctic and antarctic. To preserve these priceless exhibits, including the flying jib boom and skeleton of a humpback whale shown above, left, a gas-fired winter air conditioner, above right, was installed so that only filtered and properly humidified air would be circulated throughout the museum buildings. The plant consists of two Bryant units, each passing 2400 cu ft of air per minute and 180,000 Btu per hr. Temperature and humidity throughout the museum are automatically controlled. AGA photo

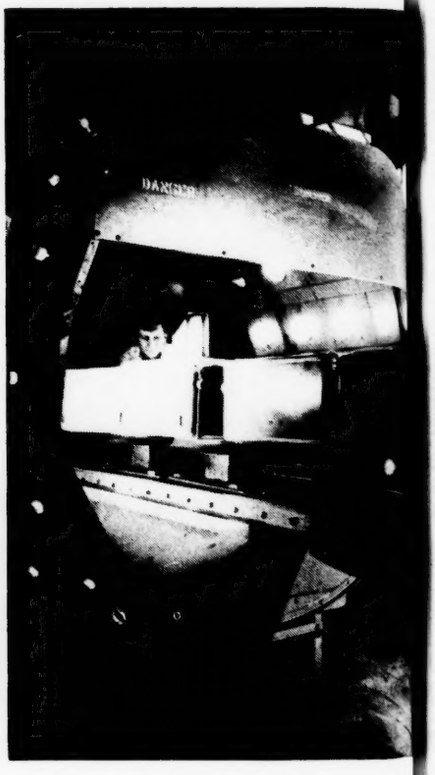
Picture Paragraphs



A general view of the block testing area where Schramm engines are tested with city gas as fuel. One of the plant's 44 gas-fired space heaters may be seen directly over the testing block and engine.



A grasshopper has its temperature taken with a thermocouple only .005 in. in diameter developed by General Electric solely for Montana State College in its experiment on the control of the grasshopper, a crop-destroying pest in that region.



Battery of 50 infra red lamps provides open end 150F oven for drying in minutes the unit heaters now in production at the B. F. Sturtevant Division of Westinghouse Electric Co.

← The *Neville*, a Union Barge Line towboat, moves down the Ohio River with part of the largest steel pipe shipment —9,000 tons—to be shipped by inland waters since the beginning of World War II. Pipe is consigned to Corpus Christi.

→ C. M. Foust, chief engineer of the high-voltage and neucleonics division of the G-E lab, checks a new electronic leak detector which can spot a hole so tiny 15,000 years would be required for a quart bottle of air to leak through it at atmospheric pressure.

Effective Exhaust for Tanks

B. F. POSTMAN† and WILLIAM P. BATTISTA†

In this concluding part of a two-part article, the authors present examples of how to correct poor practices in exhaust ventilation.

FIG. 4 shows what happened at alkali cleaning and nitric acid bright dip operations when inadequate exhaust was provided in ineffective areas. Brass shells were being processed as casings for hand fire extinguishers. The alkali cleaning tank, located at the far end of the system, was 8 ft long by 3 ft wide. Recommendations were made to exhaust 4800 cfm from this tank by means of a rear type hood complete with two 14-in. diameter connections. There was installed a 1-in. slot, located at the rear edge of the long side of the tank, which slot was part of a manifold leading to one 10-in. diameter connection. The photograph clearly shows the ineffectiveness of the exhaust.

A serious condition did develop at the bright dip tank. The outer tank, containing the rectangular ceramic tank of nitric acid, was 7 ft long by 3 ft wide. The acid tank occupied half the length of the outer tank, the remainder being used for the cold water rinse. The original recommendations were to exhaust 4200 cfm from this outer tank through two 13-in. diameter connections. A 1-in. slot, similar to that used for the alkali cleaning tank was installed, the slot manifold leading to one 10-in. diameter connection.

As soon as the cycle of cleaning operations was started, the operator was almost overcome by the excessive dispersion of the toxic oxides of nitrogen. The slot exhaust just didn't function. The reason becomes apparent when the location of the tray of shells in relation to the exhaust slot is noted, after it had been withdrawn from the cold water rinse. The heavy brown oxides of nitrogen shown under the tray and above the shells, permeated the entire working area, and naturally affected the breathing zone of the operator. Fortunately, the bright dip tank was located near the exhaust fan. The additional sheet metal baffle, shown at the upper left of the shells in the "up" position, was provided with a 10-in. diameter exhaust connection which was cut into the main line near the fan inlet. The effect of this auxiliary baffle clearly demonstrates that the toxic oxides of nitrogen are being exhausted.

Fig. 5 shows variations in applying exhaust to cleaning tanks. At the left is the standard sheet metal rear-type hood without side panels, located at the rear of an alkali cleaning tank which was not very steamy, but quite irritating. Note the draw-band at the top of the transformation piece, an aid in removing the hood when it was found necessary to clean the inside surfaces of accumulations. At the left is an effective hood provided for an electrolytic alkali cleaning tank. The hood was made of 2-in. plank and heavily coated with asphaltum paint. After two years of operation there was hardly any deterioration of the planking. The zone of operation was about 2/3 of the tank length.

For normal operations, a minimum standard of 150 cfm per sq ft of tank surface has been selected for adequate control of tank operations. For bright dip tanks, this figure may be increased to 200 cfm per sq ft of tank surface. These figures are based on practical field experience and may be safely used for a majority of tank exhaust problems. It is common practice to use an air flow rate of 100-120 cfm per sq ft of tank surface. In most instances, a higher rate of flow is necessary to counteract the adverse effects of cross-drafts, which tend to lower the effective control below

†NOTE:—Mr. Postman, currently Industrial Hygiene Engineer, Employers Mutual Liability Insurance Co., New York, was formerly a Captain, Sanitary Corps, Army Industrial Hygiene Laboratory; Mr. Battista (whose middle initial was incorrectly given in the January issue) is currently with the Industrial Hygiene Laboratory, Metropolitan Life Insurance Co., New York, and also was formerly a Captain, Sanitary Corps, Army Industrial Hygiene Laboratory.

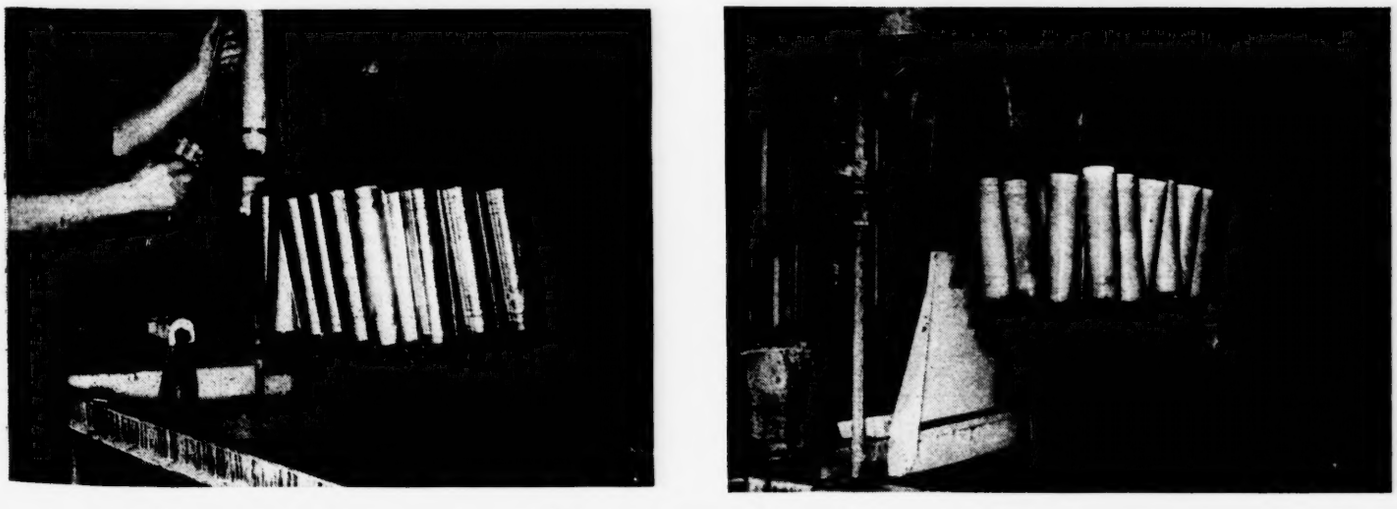


Fig. 4. Alkali cleaning (left) and nitric acid bright dip and cold water rinse operations, (right).

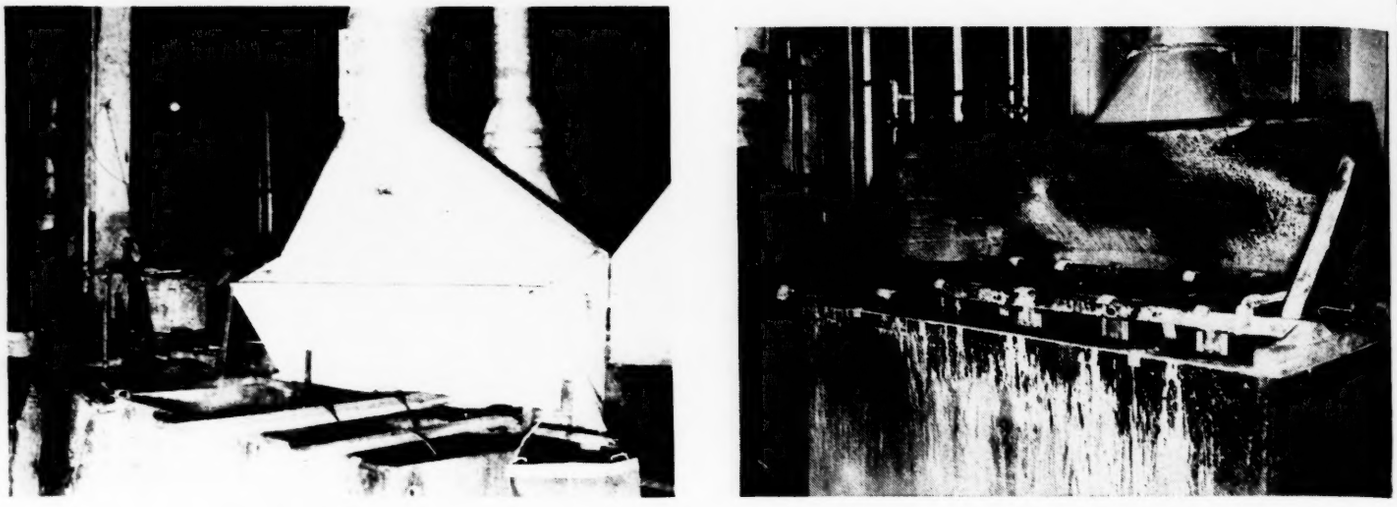


Fig. 5. Variations in hood arrangements for exhaust from alkali cleaning tanks. Left, steam-heated alkali cleaning tank; right, electrolytic alkali cleaning tanks.

desirable limits. For example, if a tank is located near a window or other opening through which air may freely enter, an entering "breeze" as low as two miles per hour, or 176 fpm, creates a cross-draft which would seriously interfere with the effectiveness of control based on low air flow.

In some cases exhaust rates of 150 cfm per sq ft of tank, bench or table surface are inadequate and values as high as 300 cfm may be necessary to provide the required control. The higher exhaust rates would be selected for controlling exceptionally toxic or volatile materials or when handling gases, mists or vapors of unusual behavior, as in the case of steam. The hood dimensions of Fig. 1 (Part 1, H&V, Jan. '47) are still applicable except that the slot widths and branch-pipe connections should be increased to maintain system

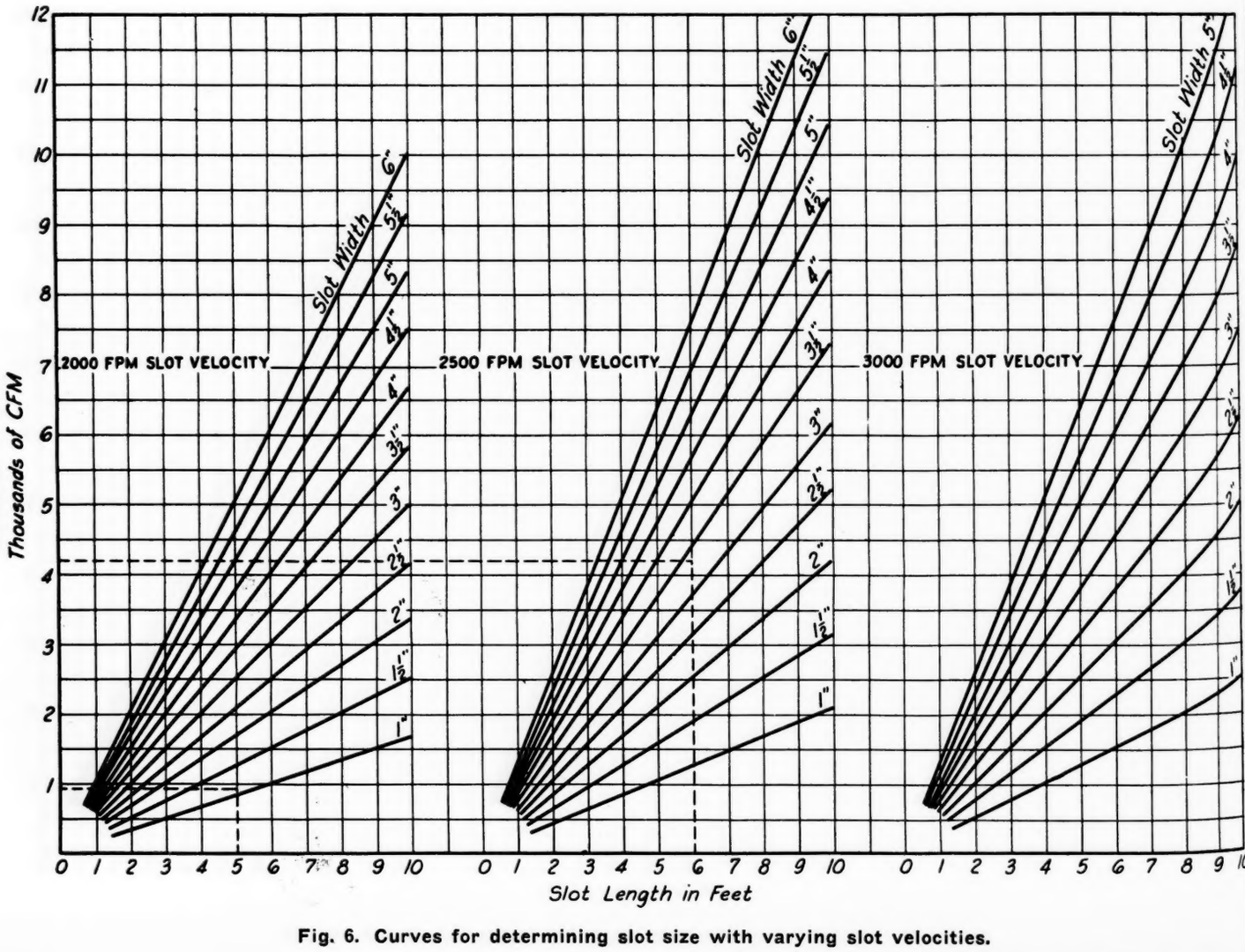


Fig. 6. Curves for determining slot size with varying slot velocities.

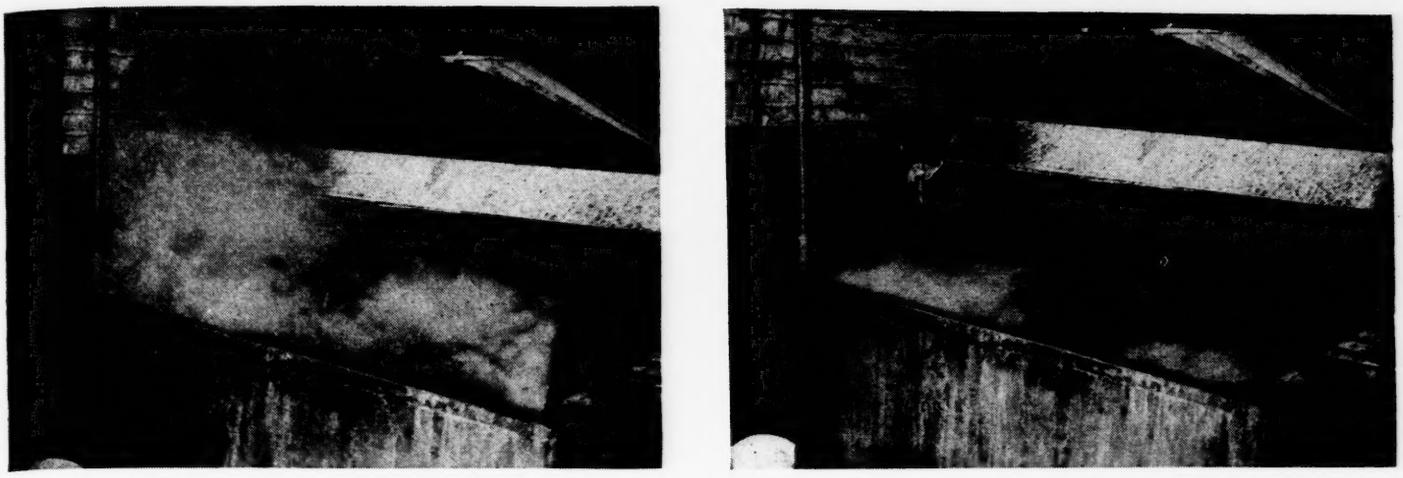


Fig. 7. Steamy rinse tanks. Left with control "Off", and right with control "On."

resistances within reasonable limits. The curves of Fig. 6 have been developed to assist in the selection of slot widths, based on slot velocities of 2000, 2500 and 3000 fpm. Two typical examples will illustrate the use of these curves.

1. *Hot Water Rinse Tank,* 7 ft long by 3 ft wide, Exhaust to be only from the rear long side.
   Assume 200 cfm per sq ft of tank surface. (This assumption is based on field experience covering many tank installations for this type of operation).
   (A) 7 ft by 3 ft = 21 sq ft surface area.
   21 by 200 cfm = 4200 cfm to be exhausted from this tank.
   (B) Using the center curves for 2500 fpm slot velocity, the intersection of the 6 ft long slot and 4200 cfm indicates a slot width of approximately 3½ in. Slot widths of ¼ in. variation may be interpolated from these curves. (The 2500 slot velocity conforms approximately to the air velocity in the sub-branch connection, thereby decreasing the slot width but increasing the loss through the hood. For most designs, 2000 fpm may be used.)
   (C) Since the hood is over 4 ft long, two exhaust connections should be used, each handling 2100 cfm. By referring to a standard friction chart, the size of each branch connection will be 12 in. diameter resulting in a sub-branch velocity of 2670 fpm. To maintain the same velocity in the combined branch-connection, the selected connection will be 17 in. diameter.
2. *Chrome Plating Tank,* 5 ft long by 30 in. wide. Standard exhaust jackets or manifolds are required on both of the long sides of the tank.
   (A) 5 ft by 2.5 ft = 12.5 sq ft of surface area. 12.5 by 150 cfm (recommended exhaust rate for this type of operation) = 1875 cfm to be exhausted from this tank. Since there will be two exhaust slots, each slot will handle approximately 940 cfm.
   (B) Using the left curves of Fig. 6 for 2000 fpm slot velocity, the intersection of the 5-ft long slot and 940 cfm indicates a slot width of approximately 1¼ in.
   (C) By referring to a standard friction chart, the branch connection for handling 1875 cfm (the two manifolds being brought to one connection) will be 12 in. in diameter resulting in a branch velocity of 2400 fpm.

In connection with air velocities to be maintained in piping systems (except for dust-collecting systems), it has been considered economical to maintain velocities ranging from 2200 fpm to 2700 fpm. These velocities will result in fairly economic pipe sizes without developing excessive friction losses in the system. In general, average system resistances based on the above velocities will range from 1 in. to 1¾ in. static pressure except where flexible metal hose is used as a part of the piping system.

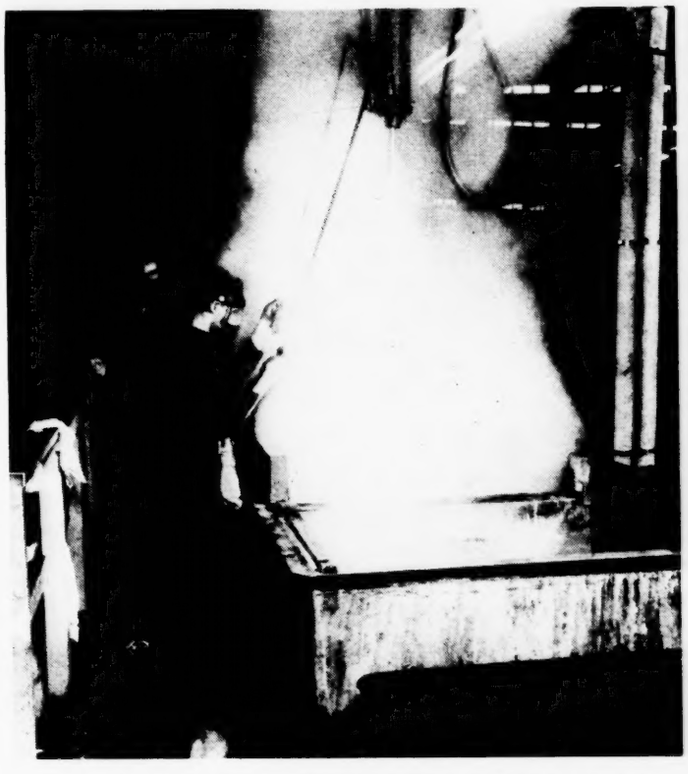


Fig. 8. Uncontrolled steam dispersion in wide alkali cleaning tank.

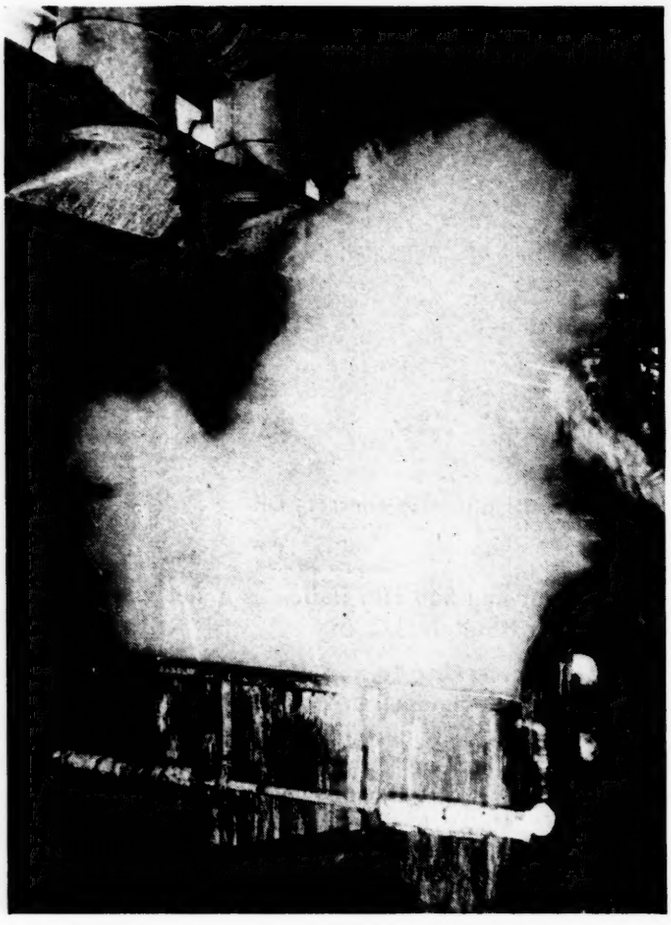


Fig. 9. Controlled steam dispersion in wide alkali cleaning tank.

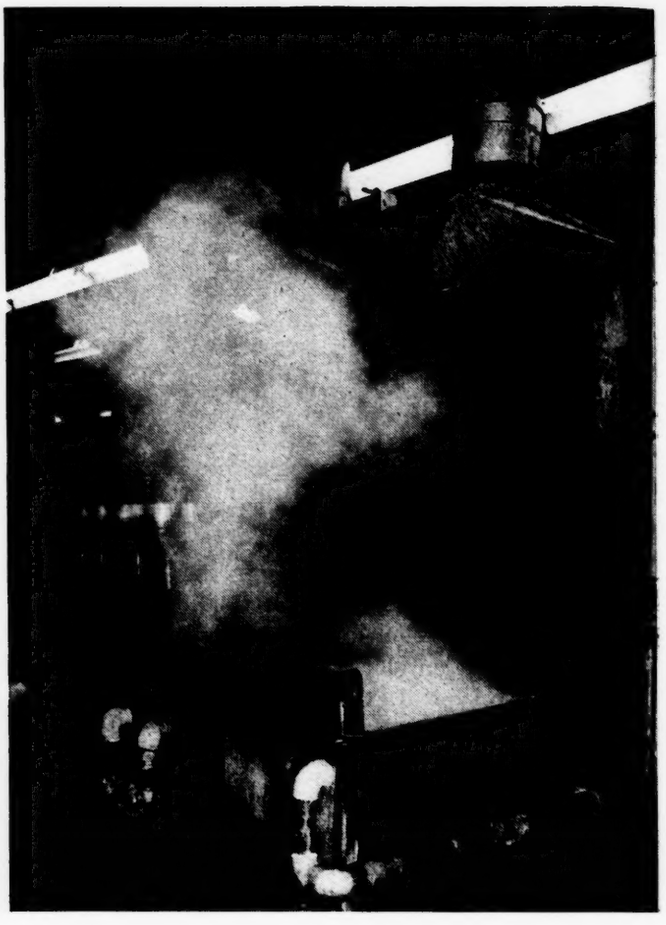


Fig. 10. Controlled steam dispersion on a narrow alkali cleaning tank.

For the water rinse tank shown in Fig. 7, 200 cfm per sq ft of tank surface have been used. The control "on" (right view) clearly shows the entrained steam distributed fairly well throughout the entire length of the hood opening and effectively exhausted.

Whenever possible, it has been found most advantageous to provide side plates or baffles as shown in Fig 7. These baffles tend to reduce the "side-swiping" action of air currents from adjacent exhaust systems, open windows, etc., and should be employed unless they seriously interfere with operator technique. However, if the objection to the installation of baffles lies only in the need for the operator to raise his work a little higher in moving it from tank to tank, either manually or automatically, if is frequently possible to overcome his objections by pointing out the benefits he will derive from their use.

When used on electrolytic tanks, these baffles may be made of wood to reduce the possibility of short circuits between the bus bars or work rods and the hood.

Excessive steam dispersion from operations which may at first sight seem "uncontrollable," may frequently be effectively controlled by the use of rear-type hoods. One such installation, covering the cleaning of 5-in. diameter brass shells which were being resized so that they could be filled and fired again, was of special concern to one of the army arsenals.

The heaviest steam dispersion occurred at the first two of four processing tanks. The first tank contained a concentrated alkali solution maintained at 200F. The second was a hot water rinse tank maintained at the same temperature. The third tank contained a cold 10% sulphuric acid rinse, while the fourth contained a cold 7% dichromate rinse which was air agitated to increase its effectiveness. These tanks were 3½ ft long by 5 ft wide. The heavy wire mesh baskets containing the shell cases, practically filled the inside of the tanks when immersed, or in the "down" position. This condition definitely prevented the installation of a hood which would overhang any section of the tank surface. An overhead air-operated cylinder type hoist precluded the use of any type of overhead hood.

When the basket of shell cases was lifted from the first or second tank, steam would rise to a point 8 to 10 ft above the tanks. The extent of the steam dispersion is clearly shown in Fig. 8. Condensation drip from the two-inch concrete slab roof deck above the tanks was so severe that before the exhaust system was installed it was found necessary to suspend corrugated sheet iron panels from the underside of the roof to catch most of the condensed steam.

A proposed control for this situation included one 5-in. by 6-in. manifold provided with a 3-in. wide slot located at the rear edge of the tank similar to the standard slot exhaust provided for chrome plating tanks. A 9-in. by 26-in. rectangular duct, equivalent in area to an 18-in. diameter duct, was selected to exhaust all of the steam, acid and dichromate mist from the four tanks. (The final design required a 33-in. diameter exhaust duct.) One's imagination need not be stretched very far to determine whether the

proposed exhaust would function when the condition, as represented in Fig. 8, is evaluated.

Considering the physical limitations which surrounded any type of control contemplated for this job, it was finally decided to utilize the rear-hood arrangement as shown in Fig. 9. Because of the exceptional tank width (5 ft), the forward edge of the hood was located almost 5 ft above the tank surface in an effort to "trap" and exhaust at least 75% of the dispersed steam and contaminants. Air quantities were based on 250 cfm per sq ft of tank surface. An inspection of the photograph shown in Fig. 9 clearly demonstrates that all of the dispersed steam was not exhausted.

Immediately after the photograph was taken, practically all of the steam which is seen in the upper right section and which appears to be beyond the influence of the hood suction, was whipped into the hood. About 95% of the steam dispersed from the tank was trapped and removed. The air volume exhausted, equivalent to an air column 10 ft high over the entire tank surface, is removed 25 times every minute.

Fig. 10 illustrates the results over tanks 3½ ft square. The rear-type hoods are located at the same height over the tanks as the previously described set of tanks, but the air volumes used were based on 200 cfm per sq ft of tank surface. In this case, about 85% of the steam dispersed from the tanks is exhausted.

These examples illustrate a fundamental and important principle:

Relatively large air quantities are required effectively to control excessive steam dispersion from industrial operations, chiefly because water, when flashed into steam at atmospheric pressure, is increased in volume approximately 1,650 times.

Steam Jet Fuel Pulverizer

An example of the effort to increase efficiency on the coal burning equipment front is a new pulverizer that enables power and steam plants to feed coal to their boiler burners in a fluid stream. Known as the steam jet fuel pulverizer, it is produced by Blaw-Knox Company and was publicity revealed for the first time at the recent power show in New York.

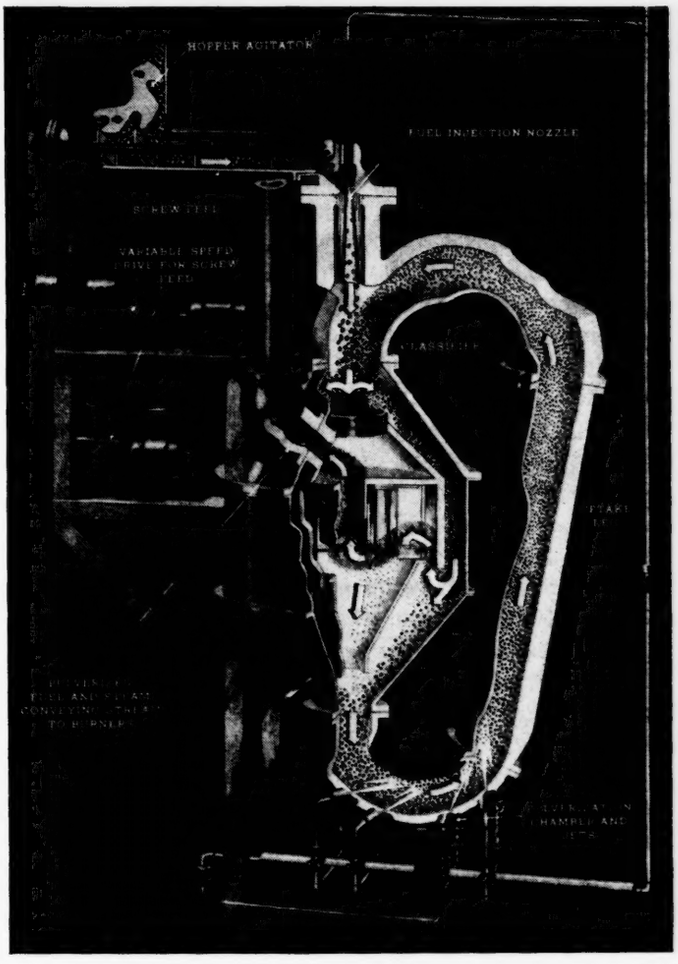
The unusual thing about this device is that it has no moving parts, except for a screw drive that feeds fuel into the unit. Super-heated steam (at a temperature of 750 to 900°F. and a pressure of 100 lb) does the pulverizing. The powdered coal is then entrapped by steam and delivered to the burners in a fluid stream, much like a gas. This stream-like movement of the fuel provides a high safety factor and permits precise control. Engineers report that the fluid-like coal achieves very complete combustion. As a result there is little opportunity for the formation of smoke, and fly ash is confined to mineral and unburnable residue.

Three installations have been in service in plants at Chillicothe, Ohio, and Buffalo, N. Y., and on the basis of favorable results the company has announced the development and scheduled production of the pulverizer.

The pulverizer operates on either wet or dry coal; that is, the coal need not be pre-dried. The units are small in size and can be set on ordinary floors without special foundations. They are adapted for capacities up to 10,000 pounds of fuel per hour as required.

The steam may be separated from the coal at the burners, or in successive stages before it reaches the burners; or, if desired, it may be sent through the burners into the boilers. The first alternative would be typical practice for most power and steam plants and would permit the salvage of residual heat in the steam.

A special model is adapted for use in pulverizing anthracite and the pulverizer can be used with any of the solid fuels in commercial use—bituminous, semi-bituminous, anthracite, or coke breeze. The anthracite model employs a special arrangement of the steam jets. An "electric eye," trained on the flame at the boiler burners, insures automatic stoppage of the pulverizer in event of loss of ignition due to any cause.



Cutaway diagram of steam jet fuel pulverizer

Panel Heating Control

ALTHOUGH the art of radiant or panel heating is rather old, design technics (and even some of the fundamental reasoning) are still by no means precise. The subject of radiant heating control is one phase of panel heating which, when raised, often begins as spirited discussion. On the one hand are those who feel that control from an air temperature thermostat is adequate, while others argue that air temperature, being only one of the important variables, is not one that can alone be responsible for the control of the system.

In view of this background, the publication of a book on radiant heating control by one of the largest control manufacturers is a matter of considerable interest. This 39-page book which appeared a month ago, is entitled "Automatic Control of Radiant Panel Heating," and is published by Minneapolis-Honeywell Regulator Company.

No author's name is listed, but a foreword credits " . . . invaluable assistance . . . . . from Mr. F. W. Hutchinson . . . . " The latter has been a heavy contributor to the literature of radiant heating, and has been engaged in research on this subject both at University of California and at Purdue University. From the wording of the foreword one assumes that the publication has been prepared by the company's own engineers with the cooperation of Professor Hutchinson.

The book opens with a comparison of panel and convection heating and rapidly leads up to a premise that for comfort, air temperature must be increased as the temperature of the enclosing surfaces decreases, and vice-versa, a statement which probably is widely acceptable. The exact relationship, on which there may not be such general agreement is the "comfort equation" $t_a = 140 - t_m$ (where t_a is the air temperature and t_m the average surface temperature of the enclosure) and said to be applicable to any room in which the air movement is not unusually great.

Following a discussion of the control requirements of convection systems, then of combined convector-panel systems, control of panel systems is examined. The authors conclude that: "With existing methods, then, the heating panel dissipates a significant fraction of its energy output by convection, in addition to the energy dissipated by radiation. Consequently, the room air temperature of the room is determined in part by the air temperature, in part by direct radiant transfer of heat from the panel to the unheated surfaces, and in part by the temperature of the panel as a factor in the overall average, since the area of the panel is a considerable fraction of the total surface area. It follows, therefore, that a given change in panel temperature will in general have more influence on overall surface temperature than on air temperature, although the difference varies both with the location of the panel and with the relative magnitude of the convective heating load, which in turn depends largely on the ventilation factor."

This leads to a subsequent statement that: "The foregoing discussion may be summarized as follows: Optimum comfort may be realized in an enclosure with general space heating, irrespective of the type of heating system used, only if the room air temperature is continuously varied as a function of outside air temperature, and in a direction opposite to the trend of average inside surface temperature. For convective heating systems the departure of air temperature from 70F as load increases should be upward, but, except in very unusual structures, it is so small as to be of no practical significance. Because of its relative unimportance, most designers of convective type systems give little attention to the air temperature variation, but design for a fixed value such as 70F, and specify controls intended to maintain that temperature in the enclosure for all loads. For panel heated structures the situation reverses. The departure of optimum inside air temperature from 70F as the load increases is downward and is frequently of a magnitude which requires that means of control be provided to permit continuous variation of this temperature as a function of the load—usually assumed to vary as a function of the outside air temperature" and finally to the con-

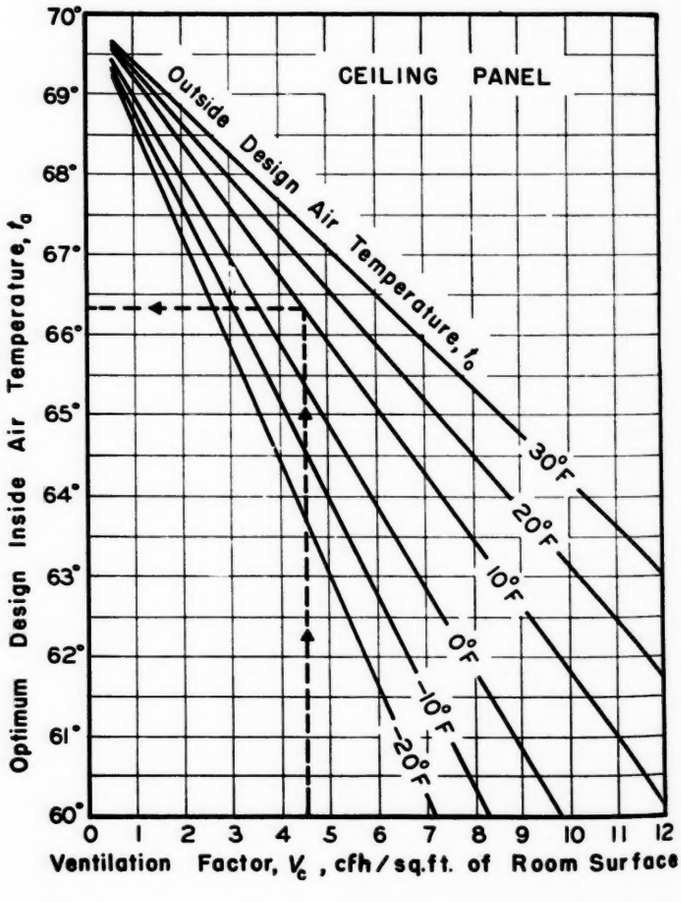


Fig. 1. Ceiling panel graph. Valid for design panel surface temperatures from 95F to 125F and for all ordinary structures (U_c from 0.05 to 0.20). This graph and Fig. 2 and 3 are reproduced by permission from "Automatic Control of Radiant Panel Heating".

clusion that: " . . . . hence tne air temperature alone can never be regarded as an adequate criterion of control," and subsequently " . . . . . air temperature can be used *indirectly* as a criterion of control, but only by a designer who provides a control system which will establish the special relationships that make this possible. Add to this the necessity of lowering the air temperature gradually as the load increases, and it should be obvious why, until the simple principles of the panel system are understood, there is always very grave danger of mis-using thermostatic control and thereby introducing conspicuously unsatisfactory performance of the heating system."

The book calls attention to the difficulty of panel heating control in emphasizing the sluggishness of a radiant system in saying that: "Because of its greater thermal capacity a panel system of the usual type is inherently sluggish in its response to load changes and the probability of hunting is great unless special consideration is given to an anticipatory feature in the control system. There are, of course, many heating systems of conventional type in which the problem of slow response of the boiler or furnace may require careful control design, but the panel system is unique in that the thermal inertia of the system is concentrated at the most undesirable location; that is, at the heat-dissipating element, the panel, located *in the occupied space.*"

An important step in the reasoning involved is that taken when the authors conclude that for any given structure under any given set of operating conditions there is one and only one combination of surface temperature (of the panel) and air temperature which will satisfy both the comfort equation and the heat balance of the structure. The satisfaction of these equations requires that, for optimum comfort, " . . . a panel heated room will have its *minimum* air temperature when under maximum load, in contrast with a convection heated room for which the *maximum* air temperature should correspond to maximum load. The minimum air temperature is precisely what must be determined."

The importance of the foregoing steps is apparent when the subsequent and final step of this phase is expressed in these words: "Thus in designing a panel heating system it is incorrect to select either a design value of the inside air temperature or of the inside surface temperature; an accurate design must be carried out by heat balances in which the panel area (or temperature) and the inside air temperature are unknowns to be evaluated as a result of the design procedure."

At this point panel heating design procedure is reviewed, and parts of this section of the book is based on Hutchinson's equations for an equivalent overall coefficient of heat transfer coefficient U_e, said to be the most significant single factor in influencing *design.* However, from the standpoint of *control, ventilation rate* is the factor of greatest importance, the authors state, since this is most influential in determining the optimum comfort inside air temperature.

Since the air change method of determining ventilation rate is reported as too inaccurate for *control*

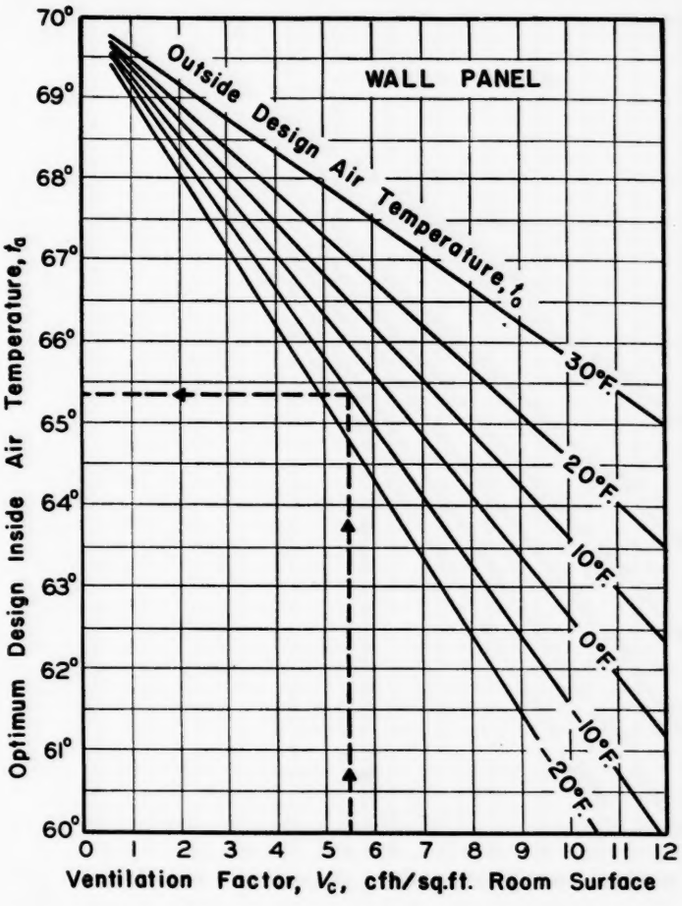


Fig. 2. Wall panel graph. Valid for design panel surface temperatures from 95F to 125F and for all ordinary structures (U_e from 0.05 to 0.20).

purposes, it is suggested the ventilation factor be calculated by the formula:

$$V_c = \frac{10C}{LW + WH + LH}$$

where V_c is the ventilation rate in cubic feet per hour, C is the lineal feet of crack in outside windows and doors, and L, W, and H the length, width and height of the space in feet.

Hutchinson's equations (as originally presented in various ASHVE papers) are then appraised from the viewpoint of control and for most cases these equations can be simplified to the point when it can be shown that the inside air temperature is a function of the outside air temperature and the ventilation factor (V_c) and the panel location.

Graphical solutions of the simplified equation are presented for ceilings, walls, floors to enable the determination of t_a when t_o and V_o are known (see Fig. 1, 2 and 3). The value of t_a thus determined is valid only for the design value of t_o and is a minimum value. This figure indicates the need or lack of need for a control system that will vary the inside air temperature as a function of load. In this connection it is pointed out that: "Work with the graphs will soon show that there is very little need for such variable control in well-insulated residences with moderate window area, but that the use of large window areas in a house or the use of mechanical ventilation (as in office buildings, shops, etc.) will necessitate provision

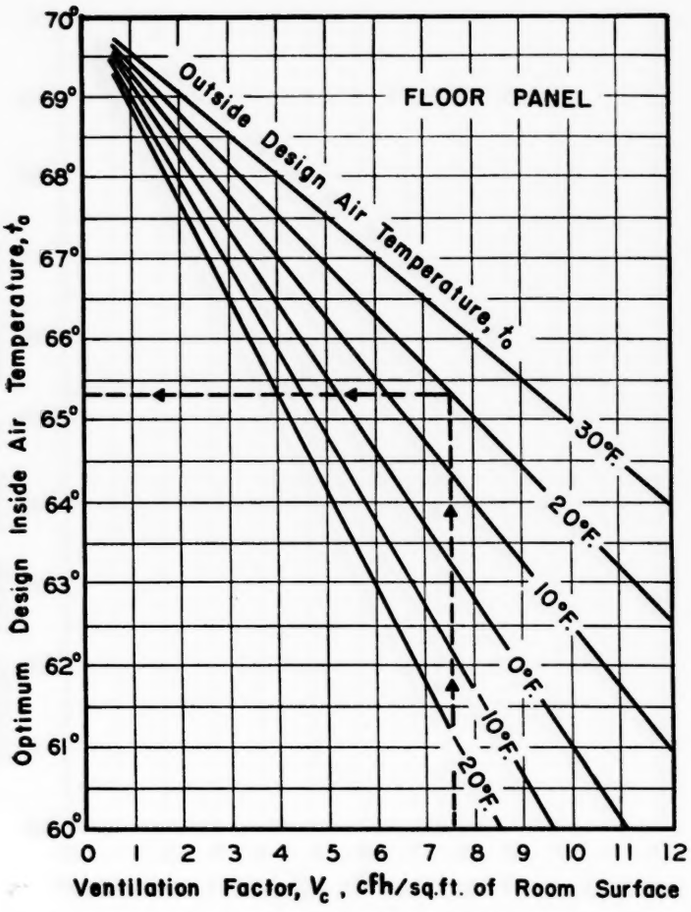


Fig. 3. Floor panel graph. Valid for design panel surface temperatures from 80F to 105F and for all ordinary structures (U_e from 0.05 to 0.20).

of a control system which will permit re-setting of the inside air temperature as a function of load."

When it has been determined that the reduction of room air temperature below 70F at maximum load, for optimum comfort, is (or is not) large enough to require control in terms of a reset control point, it is still necessary to estimate how the thermal inertia of the panel and of the structure will influence the control response of the installation. The apparent time lags involved depend upon the thermal capacity and resistance of panel and structure, and influence both the effectiveness of control during periods of changing load and the stability of control under a given load.

Perhaps the most important point covered in the whole book, however, is the relationship between the thermal inertia of the structure and the thermal inertia of the panel. Three different conditions to be met are where the panel is light, the walls heavy; where the panel or slab is heavy, the construction of the structure is light; and third, where both are light or heavy. In regard to this, the authors conclude that: "usually a light panel may be controlled by a room thermostat (with control point reset when necessary); a heavy panel, by an outside controller (qualified when necessary by an inside controller).

"In all but the exceptional cases, the panel will either be light enough to be amenable to room thermostat control or heavy enough to require control by a weather-sensitive element, regardless of the thermal inertia of the structure. In the case of a heavy panel in a light structure, difficult as it may be to achieve fully satisfactory control, an outside controller will at least take advantage of what structural lag is available to compensate for the lag of the panel.

"As has been previously indicated, the lowering of room air temperature with outside temperature will be unnecessary, by any but the strictest standard of comfort, except where the number or construction of windows or the use of untempered mechanical ventilation introduces a comparatively large ventilation load. When necessary, this variable air temperature may be provided, with a light panel, by resetting the control point of the room thermostat. With a heavy panel, accurately designed and operating under command of an outside controller properly adjusted, the variation of air temperature may be provided automatically."

The book includes the carrying through of an actual example, as well as schematic diagrams for panel controls for various types of systems and character of panel in regard to inertia.

It seems probable that no one treatment of a subject so controversial as radiant heating and radiant heating control can be expected to meet with universal approval. It is also true that there seem to be some premises on which all may not agree. Nevertheless, the reasoning, on the whole, is logical and forceful, and exceptionally well presented. The book is undoubtedly an important contribution to the literature of radiant heating and is recommended reading for every heating engineer.

Paint for Ducts

"Color in designating pipes, ducts and fittings is an old subject that needs revised thinking," says Samuel G. Hibben of the Westinghouse lamp division, in an address before the National Paint, Varnish and Lacquer Association.

"Color is about the only method of unmistakingly marking the contents of pipes and ducts, and no person interested in color or paint or safety can afford to neglect this safety measure. For example, it would be logical to band sprinkler pipes with the red that is the accepted fire protection and equipment color. Drinking water pipes would be banded green as the accepted color for safety equipment. Acetylene pipes would be orange, a color suggesting acute danger. And so on.

"For machine tools it has been suggested that basically four standards of gray be adopted, as light gray, medium light gray, medium dark gray and dark gray. So with shop machinery and office machinery, including typewriters. It is not hoping too much to expect the black, glossy finishes of typewriters, calculating machines or machine tools be changed to a much improved light gray without specular surfaces to which can be added highlights of color, if needed, to designate points of danger or caution."

What happened at Cleveland

January 27-30, 1947

7th International Heating and Ventilating Exposition

53rd Annual Meeting, American Society of Heating and Ventilating Engineers

33rd Annual Convention, National Warm Air Heating and Air Conditioning Association

ALL records for attendance at heating and ventilating expositions, meetings of the American Society of Heating and Ventilating Engineers, and of the National Warm Air Heating and Air Conditioning Association were broken during the week of January 27-31 in Cleveland, where the Seventh International Heating and Ventilating Exposition, the 53rd annual meeting of the ASHVE, and the 33rd annual convention of the National Warm Air Heating and Air Conditioning Association were held.

At the show, where three hundred exhibitors displayed their post-war line of equipment, attendance was tabulated at 30,561; 2,218 members and guests registered at the ASHVE meetings, of whom nearly a thousand attended the annual banquet, which was limited only by available space, while approximately eight hundred were registered in the warm air meetings.

Prominent among the events at Cleveland was the dedication of the new ASHVE Research Laboratory. President Alfred J. Offner, in an introductory speech, said that the dedication of the laboratory was the most important single event in the history of the Society. The dedication was by Dr. Arthur C. Willard, past president of the ASHVE and past president of the University of Illinois. Dr. Willard reviewed the history of the Research Laboratory—the first formal action on which was taken in 1917 and which was formally established on August 1, 1919.

From the Research Laboratory there has been a total of 285 research papers. During the history of the Laboratory it has had five directors, beginning with Dean J. R. Allen, followed by Dean Scipio, F. Paul Anderson, F. C. Houghton and, currently, Cyril Tasker.

Another feature of the ASHVE meeting was a heavily attended forum on panel and radiant heating at which Professor Carl F. Kayan, Columbia University, presided. Five participants outlined as many subjects, all of which was followed by lengthy discussions from the floor.

H. H. Angus, consulting engineer, Toronto, the first participant, discussed "Is There a Difference Between Panel Heating and Radiant Heating?" This was followed by a summary of the discussion on, "What Heating Mediums for Panel

Dedication of ASHVE Research Laboratory, January 27. Left to right, speaking is President Alfred J. Offner, seated on the platform are J. E. Wilhelm, Baldwin M. Woods, Arthur C. Willard, George L. Tuve.

and Radiant Heating Systems?" by Carl F. Boester, Director of Housing Research, Purdue University. Mr. Boester mentioned the commonly used media—hot water and warm air—and said that electric resistance coils were also coming into use, as well as the application of hot refrigerant gas from the heat pump cycle. He also spoke of the use of vertical tubes sealed off at one end, pulling a vacuum in the tube and employing steam as the medium. In Mr. Boester's opinion, ceiling surface is favored for coils as compared with floors and he said that the use of small tubes was desirable.

Dr. C.-E. A. Winslow, John B. Pierce Foundation, New Haven, spoke on, "What is the Comfort Temperature in Panel Heated Rooms?" He briefly discussed operative temperatures as useful in determining desirable conditions with panel heating.

W. Bruce Morrison, Portland, Ore., in talking about the question, "Does a Panel or Radiant Heating System Save Fuel?", concluded that insofar as the average residence is concerned, the saving with a radiant heating system over a convection system is insignificant. R. L. Byers, of Cleveland, talked about "Control Requirements for Panel or Radiant Heating Systems."

Newly elected officers of the American Society of Heating and Ventilating Engineers for the year 1947 are: president, Dr. B. M. Woods, Director of University Extension, University of California; first vice-president, G. L. Tuve, Professor of Mechanical Engineering, Case School of Applied Science; and second vice-president, Alfred E. Stacey, Jr., Carrier Corporation; treasurer, John F. Collins, Jr., of the National District Heating Association.

The National Warm Air Heating and Air Conditioning Association elected the following officers at its opening session Wednesday: president, F. E. Mehrings, vice-president and Sales Manager, Meyer Furnace Company; first vice-president, Atlee Wise, The Wise Furnace Company; second vice-president, C. S. Franke, American Furnace Company.

Many of the hundred or so items of new equipment shown for the first time at the Cleveland Exposition, are described beginning below on this page.

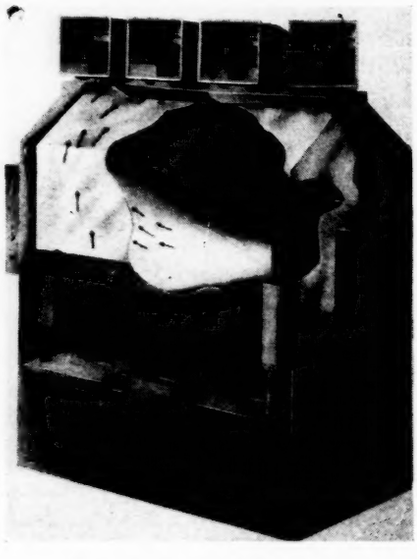
A summary of the technical papers presented before the annual meeting of the ASHVE begins on page 103.

NEW EQUIPMENT AT THE SHOW

Many equipments and devices made their first appearance at the 7th International Heating and Ventilating Exposition in Cleveland, and a considerable number of these are here described. Certain items displayed for the first time at Cleveland are not included in this section inasmuch as they have been previously described in Heating and Ventilating. Certain other equipment, due to lack of space, will be described in subsequent issues, while new equipment introduced during the month, but not displayed at the show, is described beginning on page 113. Use coupon on page 102 for further details on show items.

Direct Fired Heater

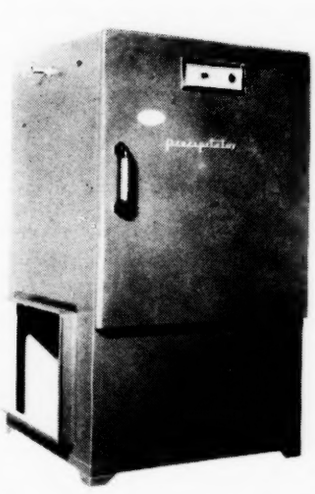
NAME—Dravo Counterflo.
PURPOSE—For open space heating.
FEATURES — Patented combustion method provides a swirling jet of high velocity air which produces a long flame that extends to the back of the combustion chamber. Makers claim that combustion is so complete that stack gases are clear and no high stack is required to eliminate smoke or fly ash, or for draft. Unit has a stainless steel combustion chamber that can operate at much higher temperatures than with standard carbon steel. With no refractory to heat up, delivery of heat is instantaneous. With stainless steel, differential between



operating and oxidizing temperatures is three times greater than with designs using carbon steel. A pointed crown sheet is used at the top of the combustion chamber. Heaters can be wall hung or suspended from roof trusses. Oil burners and controls may be replaced with gas burners and controls or vice versa.
SIZES AND CAPACITIES—Wide range of sizes with outputs from 400,000 to 2,000,000 Btu per hour.
LITERATURE AVAILABLE—AIA No. 30C43.
MADE BY—*Dravo Corp., 300 Penn Ave., Pittsburgh 22, Pa.*.....**S-299**

Air Cleaner

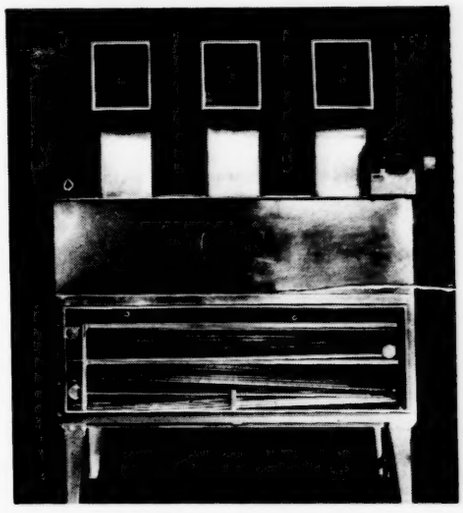
NAME—Raytheon Home Precipitator.
PURPOSE — Removal of dust from air in homes by electrostatic means.
FEATURES—The power pack, which is placed in the top compartment of the cabinet, contains electronic tubes, resistors, capacitors and other components. Below is the ionizer-collector cell supported by a steel framework. Unit is said to be a small edition of the company's industrial model.



OPERATION—Power pack which operates on regular house current, energizes the unit. As air is drawn past the positively charged wires, dust and other particles become positively charged, and as the air passes between vertical collector plates, the dust is attracted to these plates. The cleaned air passes on through to the connecting duct.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Raytheon Mfg. Co., Waltham 54, Mass.*.....**S-300**

High Pressure Heater

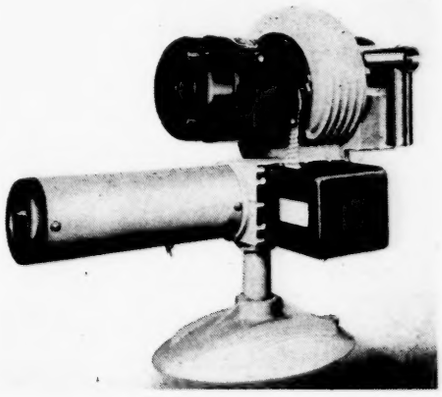
NAME—Niagara high pressure system fan heater.
PURPOSE—For supplying heat where high pressure steam is available, without the use of pressure reducing valves.
FEATURES — Heater utilizes both latent and sensible heat in high pressure steam in industrial heating systems without complications and objections to conventional methods. High pressure steam is condensed in a standard finned coil (upper coil in photo); condensate flows into trap and is admitted into low pressure coil where it flashes into steam and enters the vapor or condensing coil. This coil has its top or vapor leg finned and steeply pitched as shown. Lower, or condensate return leg, is relatively flat. Also in the condensate return header of the coil is a wire that keeps level of condensate high in that leg. Condensate is returned by vacuum pump and returned to boiler. Consequently, latent heat of high pressure steam and that in steam at low pressure, is utilized, as well as the sensible heat in the condensate. Advantages claimed include: vacuum return is vapor free; condensate returned to boiler at low temperature; system economical in installation cost; saves waste of live steam as in dump trap of



hot well methods; eliminates pressure reducing stations; self-draining on shutdown; free from hammering; simple in construction.
MADE BY—*Niagara Blower Company, 405 Lexington Ave., New York 17, N. Y.* **S-301**

Oil Burner

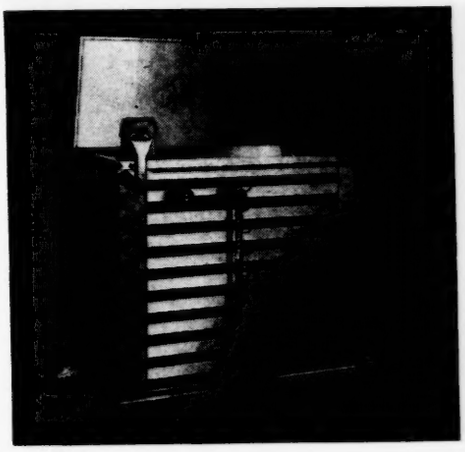
NAME—HomEase Fire-Stat combustion control.
PURPOSE—Precision control over the rate at which combustion air is fed to an oil flame.



FEATURES—Fire-Stat, which is a control to be attached to one side of the HomEase oil burner, provides a sufficient amount of air for the start of the oil burning cycle. After a few minutes operation, the amount of air is reduced. Company claims that typical CO_2 readings are between 9 and 10% for a cold start and increased to 12 to 13% with a hot firebox. Entire operating cycle is approximately six minutes. In operation, device can be compared to automobile carburetor which adjusts the mixture of gasoline and air. Damper in tube is open full at the start and gradually closes as the tube warms up.
MADE BY—*HomEase Products Division, Inc., Bogue Electric Company, 300 Iowa Avenue, Paterson 3, N. J.* **S-302**

Air Filter

NAME—Electro-Klean.
PURPOSE—Removal of dust from air in homes by means of electrostatically charged filter paper.
FEATURES—Electrostatic charge on

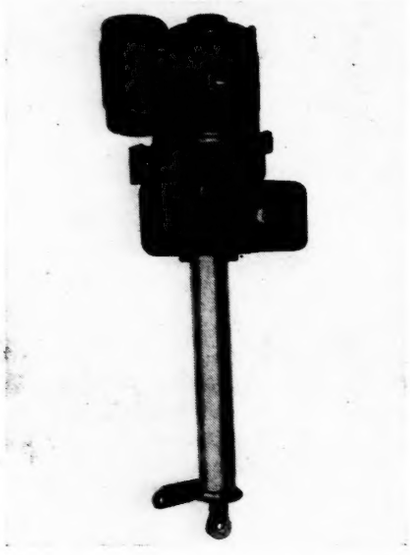


paper filters is produced by direct current at higher than normal potentials. Electrodes, sufficiently separated to prevent arcing, are placed horizontally in each section and support the Airmat paper which provides a path for the electrostatic field. Filter consists of several layers of tissue-like sheets resembling cleaning tissue, built up to form a thick mat. When the paper becomes dirty, fresh Airmat paper is automatically fed into the air filter and the dirty filter, as it leaves the unit, is collected in a receptacle for disposal. Regular 110-volt a-c is stepped up by a transformer and changed to d-c by

a rectifier tube. Current consumption is said to be less than 10 watts.
MADE BY—*American Air Filter Co., Inc., 1st and Central Ave., Louisville 8, Ky*.....**S-303**

Actuator

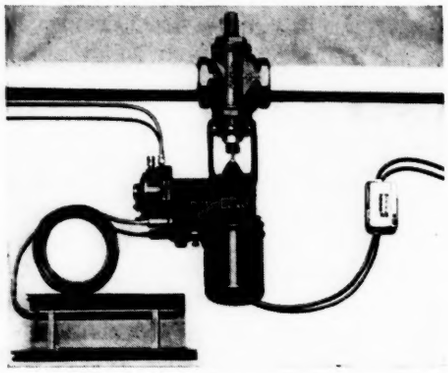
NAME — Series 6080 Perfex actuator.
PURPOSE—Regulator for automatic control.
FEATURES — Actuator delivers a strong straight line movement. It is equipped with a line voltage capacitor type reversible motor with ample power to handle the largest dampers. Length of stroke is adjustable from 3 to 6 in., adjustable



at either or both ends of stroke. Accessories are available to facilitate the best linkage between the actuator and the unit to be controlled.
MADE BY—*Perfex Corporation, 500 West Oklahoma Ave., Milwaukee 7, Wis.* **S-304**

Weather Control Valve

NAME — Sarco type EO-1 steam weather control.
PURPOSE—Weather control system for steam heating.
FEATURES—As outside temperature increases, oil in the thermostat exerts a pressure on bellows which opens a switch and controls a valve to close the main valve. The combined effect of the temperature surrounding the thermostat and the



pressure of the steam on the bellows of the device, results in a corresponding steam pressure in the system for every variation in outside temperature conditions. Once the valve has been manually adjusted for the building, no further adjustment is said to be necessary for the heating season.
MADE BY—*Sarco Co., Inc., 475 5th Ave., New York 17, N. Y.*.....**S-305**

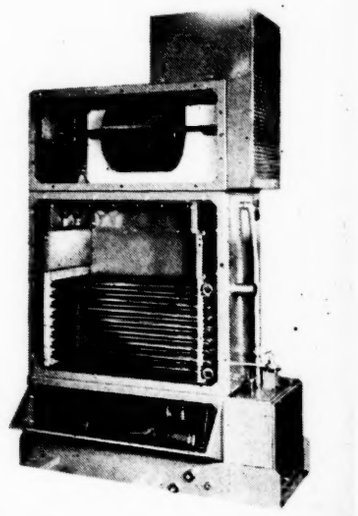
Wet Base Boiler

NAME—Arcoliner wet base boiler.
PURPOSE — For use with oil-firing for small homes.
FEATURES — Wet base construction prevents overheating the floor and is designed for installation in homes without a basement or for conventional placement. Added heating

efficiency is obtained from finned sections. Boiler can be obtained with or without built-in tank or tankless type heaters for domestic hot water systems.
SIZES AND CAPACITIES—From 260 to 835 sq ft of installed radiation.
MADE BY — *American Radiator & Standard Sanitary Corp., Pittsburgh 30, Pa.* **S-306**

Evaporative Condenser

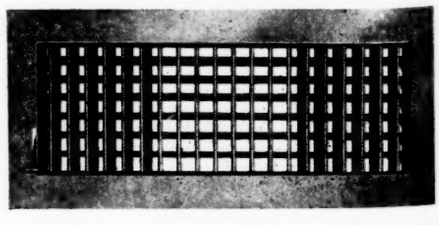
NAME—Worthington ECZ Freon and ammonia evaporative condenser.
PURPOSE — For use with refrigeration and air cooling systems.
FEATURES—Unit embodies new techniques for prevention of corrosion



and scaling. Equipment may be installed indoors or outdoors. Makers claim great flexibility and ease of operation.
MADE BY—*Worthington Pump and Machinery Corporation, Harrison, N. J.* **S-307**

Grille

NAME—Tri-flex grille.
PURPOSE—Control of air distribution.
FEATURES—Line is made of combinations of three flexible units: Grille with individually adjustable vertical face bars, pivoted at the

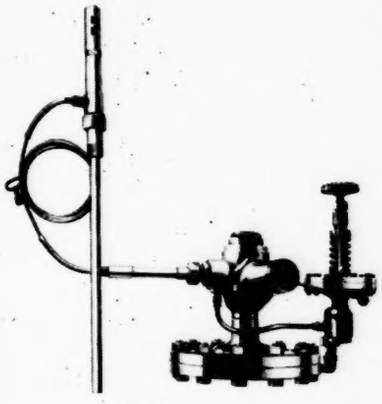


front for alignment regardless of the angle of setting; the horizontal deflector blades, individually adjustable and designed to deflect the

air stream but with an overlap feature which permits complete closure of any portion of the grille; and the multi-shutter damper.
MADE BY — *Tuttle & Bailey, Inc., New Britain, Conn.* **S-308**

Pressure-Temperature Control

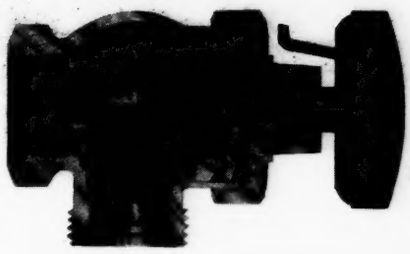
NAME—Sarco type PT-150 pressure-temperature control.
PURPOSE — Pressure - temperature control for water heaters or equipment intended to operate at low pressure but connected directly to a high pressure main.
FEATURES—A venturi nozzle is used on the valve discharge from which the reduced pressure is regulated.



By controlling the pressure pilot by means of the dynamic flow pressure, the reduced pressure automatically adjusts itself to the load on the heater. In effect this provides throttling temperature control combined with dead end shut off on no-load. Makers claim its results in closer temperature control than is possible with separate regulating and reducing valves.
MADE BY—*Sarco Co., Inc., 475 5th Ave., New York 17, N. Y.*.....**S-309**

Lifetime Valve

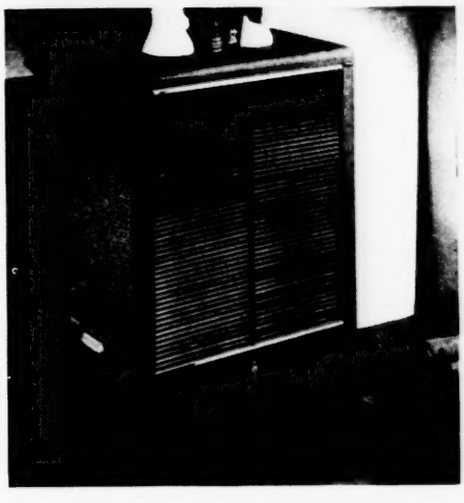
NAME — Trane Lifetime No. 44 valve.
PURPOSE—Valve designed for long time service against possibility of stem leakage.
FEATURES—Valve carries guarantee that if stem leakage occurs at any time in the normal life of the valve, a new diaphragm will be sent without charge. Valve is essentially a non-rising stem constructed valve



as the upward movement is not over 3/32 in. Recommended maximum pressure for this type valve is 25 lb. Clamped between the valve body and bonnet is a solid metal wall which hermetically seals the steam chamber from all outside contact. Valve is made of phosphor bronze.
MADE BY — *The Trane Company, LaCrosse, Wis.* **S-310**

Gas Heater

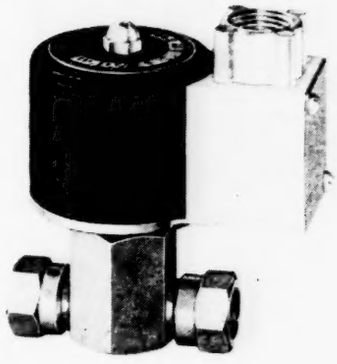
NAME—Reznor AFA gas heater.
PURPOSE—Space heating.
FEATURES—Electric fan is independently controlled by a fanstat located in front of the fan. It operates the fan when the tempera-



ture of the air inside the cabinet is sufficiently high for forced circulation. A high limit control shuts off the gas if the fan should fail or if the unit should overheat. A summer-winter switch permits operation of the fan without the heater. If the pilot should be extinguished, an automatic shut-off shuts off the gas supply. Casing of heater is lined with 1 in. of spunglass insulation so that the outside of the cabinet is always cool.
LITERATURE AVAILABLE—8-page catalog.
MADE BY—*Reznor Mfg. Co., Mercer, Pa.*.....**S-311**

Solenoid Valve

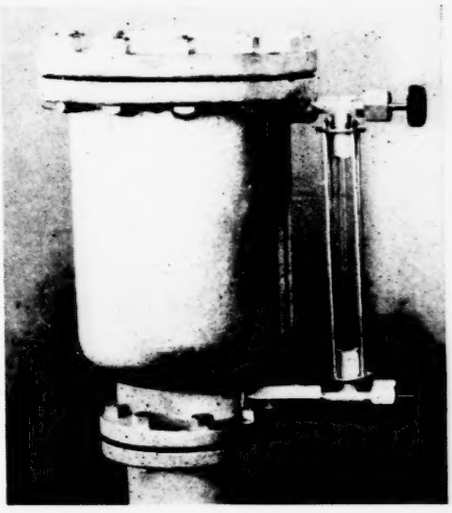
NAME—Henry valve, model SV-21.
PURPOSE — Solenoid valve for use with Freon, methyl chloride, water, air, oil, gas, etc.
FEATURES — Body is of brass and interior parts of stainless steel.



Valve has a renewable neoprene soft seat for positive shut-off. Valve has an aluminum die cast junction box.
SIZES AND CAPACITIES—2-ton Freon capacity with 2 lb pressure drop.
MADE BY—*Henry Valve Company, 3260 West Grand Ave., Chicago 51, Ill.*.....**S-312**

Gas Purger

NAME—Armstrong gas purger.
PURPOSE—To remove air and other non-condensible gas from the high



side of a refrigeration system.
FEATURES–Makers claim that purger will discharge 100 cu ft of air with only a loss of 1 lb of refrigerant gas. After being started, purging action is automatic.
OPERATION—Air and gas enter the purger, displace liquid from the trap bucket, and causes float to close liquid valve. Air and gas pass through vent in bucket and rise to top of purger. Refrigerant gas is condensed by cold liquid. Air accumulates at top of purger, float sinks, and air escapes.
SIZES AND CAPACITIES—No. 270 of semi-steel castings; No. 370 of carbon steel forgings.
LITERATURE AVAILABLE — Bulletin No. 173.
MADE BY — *Armstrong Machine Works, Three Rivers, Mich.*.....**S-313**

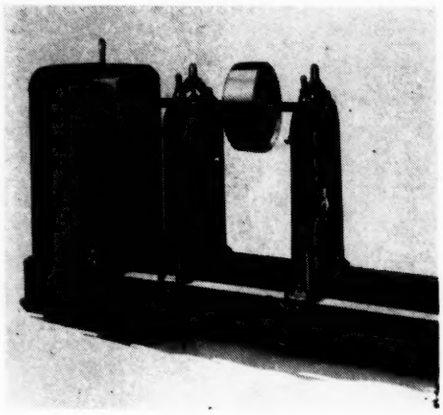
Boiler

NAME—Exbrook boiler.
PURPOSE—For heating larger than average sized homes and buildings.
FEATURES—Multi-finned flues, supplemented by fins in the crown sheet, are used to extract all pos-

sible heat from hot gases. Built-in tank or tankless type heater for domestic hot water may be had with the oil-fired model, or for hot water supply during the heating season with the stoker-fired model.
SIZES AND CAPACITIES—Rated at 775 to 2,640 sq ft of radiation.
MADE BY — *American Radiator & Standard Sanitary Corp., Pittsburgh 30, Pa.* **S-314**

Dynamic Balancing

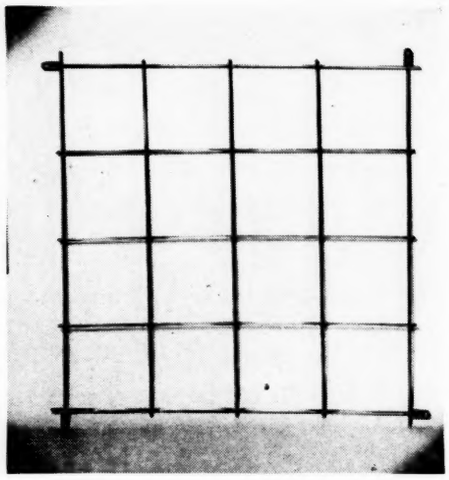
NAME—Bear dynamic balancing machine, model 375-R.
PURPOSE—For the dynamic balancing of rotating parts.
FEATURES—Adjustable column feature permits balancing a wide range of lengths. Interchangeable



flexing head assemblies are available to make machine adaptable to air moving bodies. Unit has safety locks, and shaft diameter adjustment for shafts 1 to 5 in. size.
MADE BY—*Bear Mfg. Co., Rock Island, Ill.* **S-315**

Filter Grid

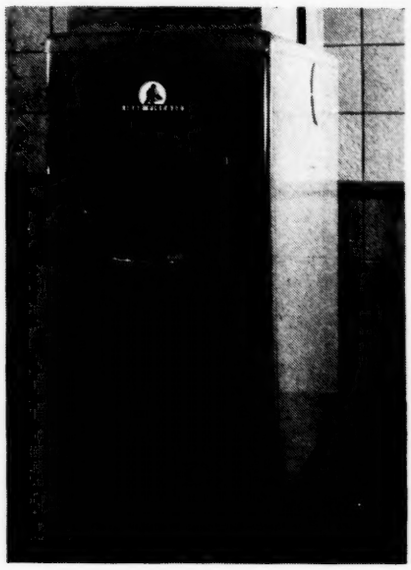
NAME—Grid for air filter banks.
PURPOSE—A method to permit easier change of air filters in an air filter bank.



FEATURES—Grids are of simple wire construction with rubber ends and hold the filters securely in the filter bank. To change filters, the grids are snapped out by hand, the dirty pads are removed, and new clean pads are snapped into place. No hooks or other special devices are required.
MADE BY—*Research Products Corp., Madison, Wis.* **S-316**

Warm Air Furnace

NAME—Airborne furnace.
PURPOSE—Space heating.
FEATURES—Unit heats, cleans, humidifies and circulates the air. Automatic control instruments include limit control to prevent overheating of the furnace and fan control. Unit is available for either coal or oil firing. With the coal

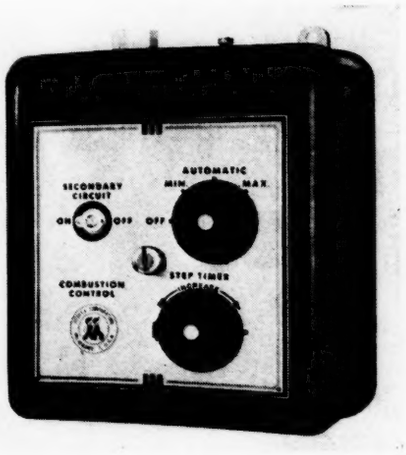


model, unit has an automatic refueling instrument to keep the fire banked ready for instant action.
MADE BY—*Iron Fireman Mfg. Co., Cleveland 11, Ohio.* **S-317**

Combustion Control

NAME — Series 7100 Perfex combustion control.
PURPOSE—For controlling the quantity of fuel and air supplied to automatic firing equipment, or to control the burning rate when fuel is fired by hand.
FEATURES — Unit operates in response to slight steam pressure changes to control dampers, valves and modulating equipment. An adjustable step timer is said to provide close, stable control of

steam pressure. Adjustments of air dampers or fuel feed are made in small steps with a definite time interval between to avoid hunting



or over-running. A secondary circuit permits interlocking with other controls.

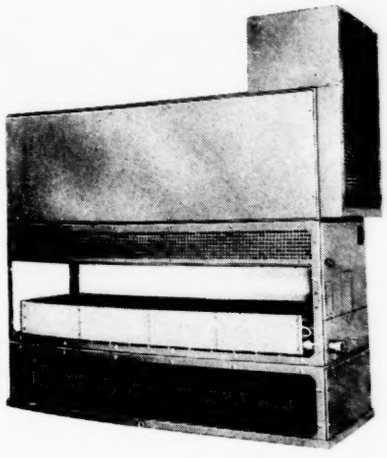
SIZES AND CAPACITIES — Available in pressure ranges of 0-35 lb or 0-165 lb.

MADE BY—*Perfex Corporation, 500 West Oklahoma Ave., Milwaukee 7, Wis.* **S-318**

Air Conditioner

NAME—Series AVY-102 air conditioner.

PURPOSE—For general central plant air conditioning.



FEATURES — Both horizontal and vertical air flow models are available. Floor mounted units may be installed with front, top or rear air discharge. Units are available with four or six-row direct expansion coils and four, six or eight rows of water coils. Filter boxes, heating coils, and humidifiers are also available. Variable speed fan drives are used.

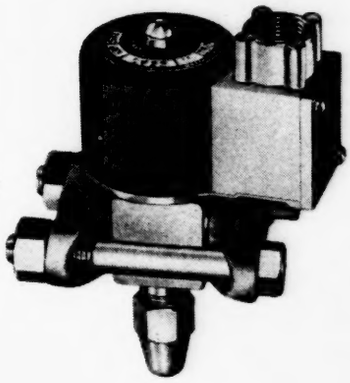
SIZES AND CAPACITIES—From 1600 to 11,000 cfm.

MADE BY—*Worthington Pump and Machinery Corporation, Harrison, N. J.* **S-319**

Solenoid Valve

NAME—Henry valve, model SV-22.

PURPOSE — Solenoid valve for use with ammonia and other fluids noncorrosive to steel.



FEATURES—Body is of steel and the interior parts, stainless steel. Renewable seat is of hardened steel. Valve has been designed for easy servicing.

SIZES AND CAPACITIES—10-ton.

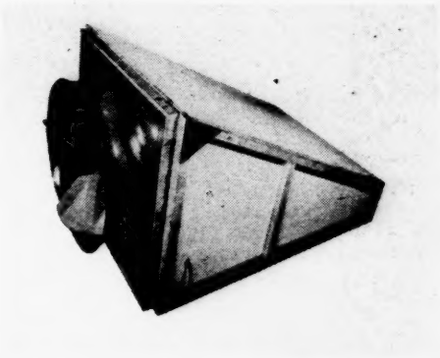
MADE BY — *Henry Valve Company, 3260 West Grand Ave., Chicago 51, Ill.* **S-320**

Suction Chamber

NAME — Prefabricated suction chamber.

PURPOSE—Leak proof enclosure for use in many fan installations.

FEATURES—Enclosures is placed between the automatic ceiling shutter or ceiling grille and the fan. Chamber is rigidly constructed of wood, reinforced with metal, with self sealing joints and sound absorbing enclosure. Chamber is fabricated in four panels which can be quickly bolted together. When installed, chamber and fan rest on vibration absorbent materials which prevent



unit from coming in contact with the attic floor.

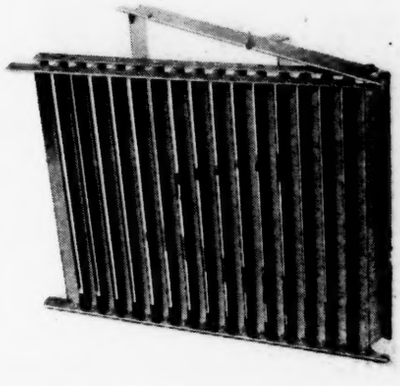
MADE BY—*Holcomb & Hoke Mfg. Co., Inc., Indianapolis, Ind.* **S-321**

Air Control

NAME—Vol-U-Turn.

PURPOSE — For control, direction and distribution of air in supply lines.

FEATURES—Unit is fabricated of specially designed air turning vanes which maintain a constant air discharge angle of 90° throughout the entire range of adjustment. Adjustment is said to be tamper-proof to



eliminate manipulations by unauthorized personnel. For rectangular and square openings, unit is mounted at the junction of the branch of take-off from the duct. When used with round openings, they can be slipped through the round branch duct into the main supply line and secured in position.

MADE BY—*Barber-Colman Company, Rockford, Ill.* **S-322**

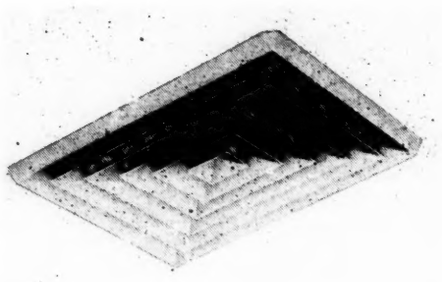
Air Distributor

NAME — Aerofuse multi-louver damper.
PURPOSE—Uniform air control.
FEATURES — Multi-louver construction divides air stream supply resulting in uniform distribution. Since the effective area of the damper in the open position is greater than that of the corresponding size diffuser, volume adjustment

can be accomplished, it is said, without affecting the capacity of the diffuser. As air turbulence passing the louver is minimized, there is a decrease in the noise factor. Damper can be completely closed, opened or left in any position by turning the handle in the center of the unit. If desired, operating handle and rod may be removed.
MADE BY — *Tuttle & Bailey, New Britain, Conn.* **S-323**

Type R Diffuser

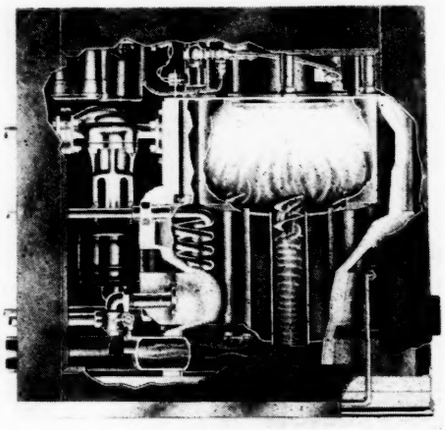
NAME—Type R Agitair diffuser.
PURPOSE—Air diffuser of square or rectangular shape assembled into numerous patterns which divide air and discharge it into one or more directions in proportion to the area served.
FEATURES—Pattern of diffuser can be supplied so as to direct air in from one to four directions, depending on shape of room and location of diffuser in room. Diffusers are all steel, rust proof construction with a wide variety of finishes. Due to pattern feature, fixture need not be located centrally.



SIZES AND CAPACITIES—Available in sizes from 6 x 6 in. to 9 x 9 ft. Only ¾ in. deep in all sizes; may be mounted flush.
MADE BY—*Air Devices, Inc., 17 E. 42 St., New York 17, N. Y.*.....**S-324**

Oil Fired Boiler

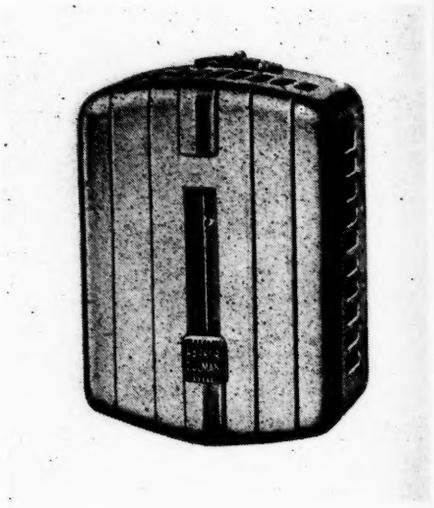
NAME—Miller boiler-burner.
PURPOSE—Space heating and domestic hot water for the small home.
FEATURES—Boiler is of fire-tube type having 9 vertical tubes. In each tube is a Spiralator which



gives a spinning motion to the products of combustion. Fire is under positive pressure in the fire box. Controls installed on each boiler-burner include constant level valve, high limit control, aquastat for summer-winter hot water, ignition control and water circulator control. Burner has a maximum input of 0.8 gallons per hour. Miller vaporizing burner is used.
SIZES AND CAPACITIES—Overall dimensions of jacket are 2 ft wide, 3 ft high and 3 ft long.
MADE BY — *The Miller Company, Heating Products Division, Meriden, Conn.* **S-325**

Air Control

NAME—Microtherm.
PURPOSE—For proportioning control of room air temperature.
FEATURES—This control has been designed as a unit of the Micro system of control and is used in



conjunction with the Barber-Colman motor-operated Micro valves, Microtrol damper operators, and switches. The actuating element is a sensitive bi-metal strip. Entire mechanism is housed in a well ventilated case.
MADE BY—*Barber-Colman Company, Rockford, Ill.* **S-326**

Damper Control

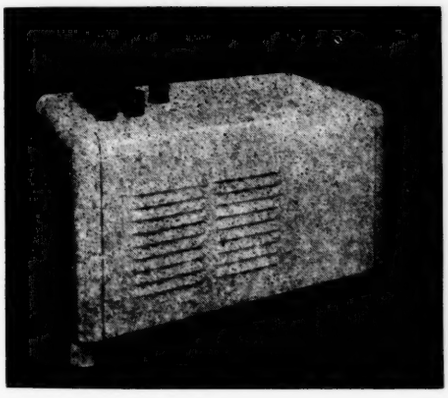
NAME—Series 7200 Perfex damper program control.
PURPOSE—For use with draft con-

trol when controlling on-off firing equipment.

FEATURES—During the off period, unit holds overfire draft down to a minimum. This prevents the excessive flow of cold air through the furnace when the firing equipment is not operating. It operates through a large sensitive vertical diaphram which moves in response to varying draft conditions, causing the actuator to operate and ties in with a fixed program through a timing clock motor.
MADE BY—*Perfex Corporation, 500 West Oklahoma Ave., Milwaukee 7, Wis.* **S-327**

Warm Air Furnace

NAME—Jet-Heet.
PURPOSE—Space heating.
FEATURES — Unit utilizes the combustion principle of the jet engine

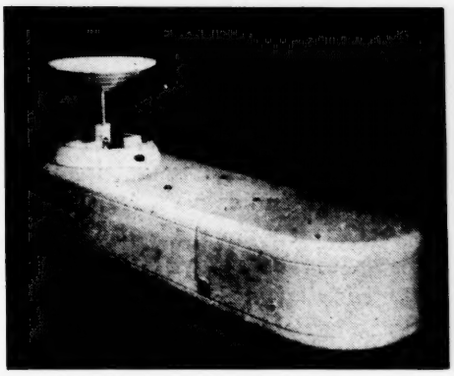


in burning fuel oil. Combustion of fuel is under very high pressure and at high velocity on a chamber the size of a pint bottle. Initial ignition is provided by a spark plug. Complete unit is in the form of a warm air furnace with several outlets on top to be connected to the warm air ducts. Makers claim that 95% of heat from hot gases is available for house heating. Present models are designed to burn No. 1, 2 or 3 fuel oil, but later ones will be produced to burn natural or manufactured gas. High limit control prevents overheating of air. Electric eye stops oil flow if flame accidentally goes out or mixture is not ignited on starting. Furnace can be connected to any duct system. Ducts are small and flexible and are made of glass fibre.

SIZES AND CAPACITIES—Two models are available. For a 5 to 6 room house, unit will deliver 65,000 Btu per hour and 300 to 550 cfm air. Fuel consumption is ½ gal per hour. Motor is 1/3 hp. For houses up to 9 rooms, the Btu output is 130,000 and the air delivery 600-1100 cfm. Motor is 1 hp. Size of unit for both models is 35 in. long, 23 in. wide, 22 in. high. Available in about 6 months.
MADE BY — *Kearns & MacCracken Corp., 103 Lafayette St., New York 13, N. Y.* **S-328**

Gas Conversion Burner

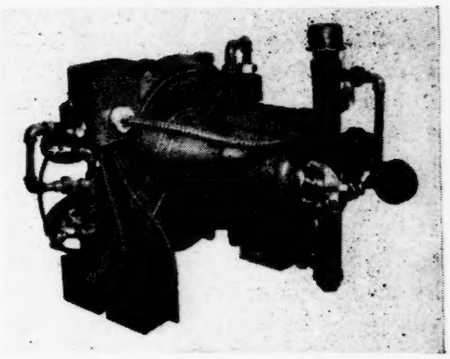
NAME—Gas-A-Fire.
PURPOSE—For converting existing furnaces and boilers to automatic gas heat.
FEATURES—All controls are housed under the back cover. A steel cover encloses all working parts. Working parts are accessible for adjustment



or repair. Burner is shipped completely assembled.
MADE BY — *Stok-A-Fire Company, 6504 Olive Boulevard., St. Louis 5, Mo.* **S-329**

Oil Burner

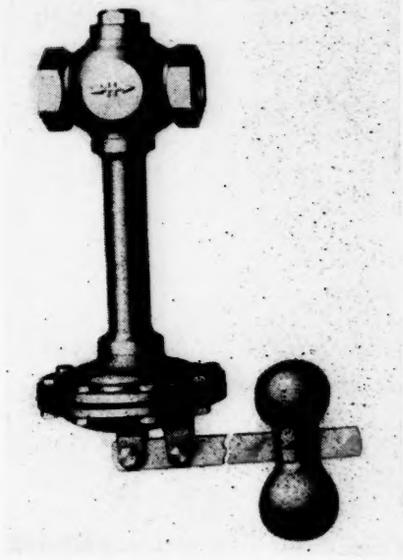
NAME—Clark National oil burner, model F.
PURPOSE—Rotary oil burner for burning heavy No. 6 industrial oil.
FEATURES—Units are designed to burn the industrial fuel oils, preheated when necessary. Manual, semi-automatic or fully automatic controls for high or low pressure operation are furnished according to the buyer's specifications. Burner



is supplied with a Westinghouse motor. Oil pump can be removed without disturbing any other part of the burner. A steel worm and bronze worm gear reduce speed to pump take-off.
MADE BY—*National Oil Burner Co., Covesville, Va.* **S-330**

Pressure Reducing Valve

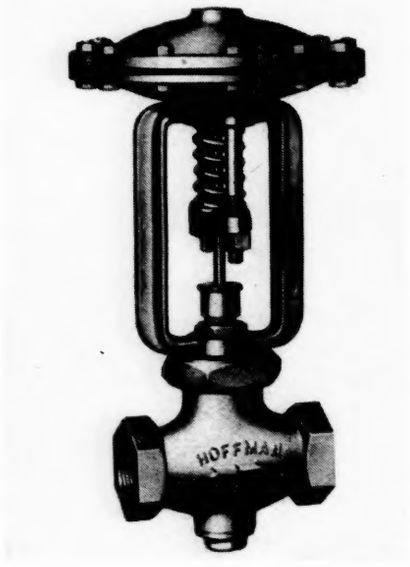
NAME—Hoffman 700 series double seated pressure reducing valve.
PURPOSE—Pressure reduction.
FEATURES—Valve is limited to continuous service application. It is said to respond quickly to slight pressure changes on the low pressure side. Diaphragm and case are interchangeable and renewable.



SIZES AND CAPACITIES—Sizes from ½ to 1½ in. inclusive. Designed for maximum pressure of 200 lb and low pressure of 1 to 25 lb.
MADE BY—*Hoffman Specialty Company, 1001 York St., Indianapolis 7, Ind.* **S-331**

Pressure Reducing Valve

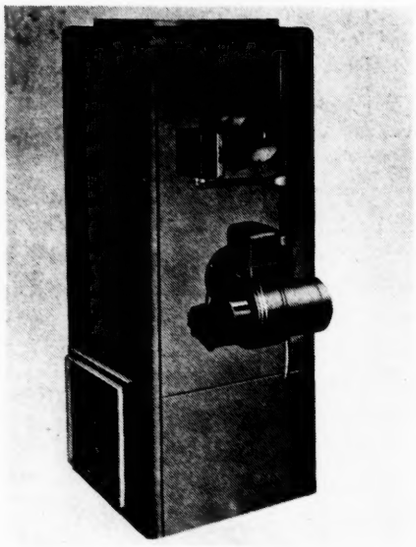
NAME—Series 710 Hoffman pressure reducing valve.
PURPOSE — A pressure reducing valve for use on either a dead end or for continuous service.
FEATURES—Valve can be used for reducing pressure in steam, hot or cold water, fuel oil and gasoline lines. By changing the disc in the valve, it can be used for water or



air pressure reductions. All valve parts are renewable.
SIZES AND CAPACITIES—From ½ to 1½ in. sizes inclusive. Designed for a maximum high pressure of 250 lb and a low pressure range from 5 - 80 lb.
MADE BY—*Hoffman Specialty Company., 1001 York St., Indianapolis 7, Ind.*.....**S-332**

Warm Air Furnace

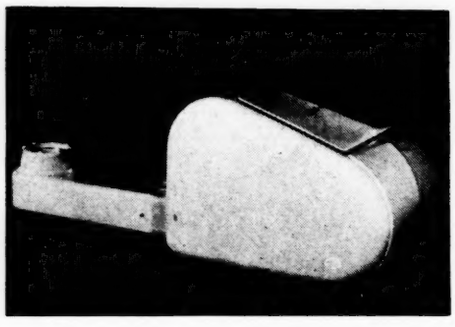
NAME—Warmaire, model 65HB.
PURPOSE — Space heating designed for veteran housing projects and small homes.
FEATURES—Furnace is a completely packaged unit requiring only electrical, thermostatic, stack and oil line connections. Unit is 25 in. square at the base and stands 5 ft high. Entire unit weighs 375 pounds. Based on 65,000 Btu per hour, fuel consumption is said to be 0.62 gal per hour. Wiring and controls are installed at the factory



and pretested. Blower is rubber mounted for quiet operation.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*York-Shipley, Inc., York, Pa.*.....**S-333**

Stoker

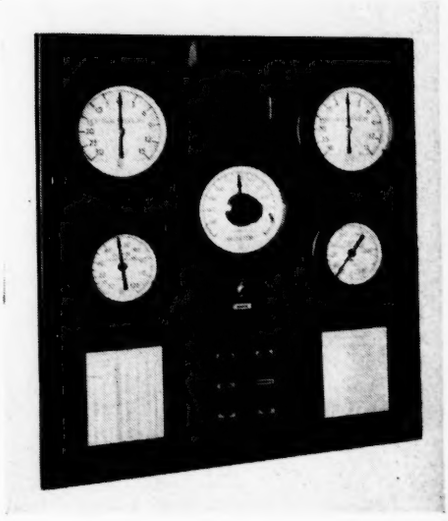
NAME—Stok-A-Fire.
PURPOSE—Stoker for the automatic burning of coal.
FEATURES—By a single adjustment, the rate of coal feed is governed and the corresponding setting for air control indicated. A built-in air system supplies all of the air directly to the retort. Fuel feed system is designed to prevent jamming by expelling hard foreign objects. The feed screw floats with a 2 to 3 in. clearance in the screw



trough. Power and transmission units are one assembly which slides out upon removal of two main assembly nuts.
LITERATURE AVAILABLE—Folder.
MADE BY — *Stok-A-Fire Company, 6504 Olive Boulevard, St. Louis 5, Mo.*.....**S-334**

Pressure Control

NAME — Illinois selective pressure control board—type C.
PURPOSE — For complete pressure control of an entire heating system, with the instruments grouped on one board.
FEATURES—Control, either manual or automatic is applied directly to the fuel burning equipment. With this control, only sufficient fuel is burned to generate steam at the selected pressure and temperature. The controller, which automatically



governs the vacuum pump, is actuated by both the temperature and the pressure existing at the pump.
MADE BY—*Illinois Engineering Co., 2035 South Racine Ave., Chicago 8, Ill.*.....**S-335**

Conversion Burner

NAME—Norman conversion burner.
PURPOSE—For converting heating units to the burning of gas.
FEATURES—Unit fits any size gravity or forced air furnace or steam or hot water boiler. Telescopic burner tube provides quick centering to any size or shape firepot. Adjustable rear support enables fast leveling. Orifice holder designed to permit quick change of orifice size in order to vary input. Extra orifices are supplied with each burner. Controls are housed in a dustproof casing. Secondary air adjustment is temper-proof and

eliminates the possible blocking or air supply to the burner.
SIZES AND CAPACITIES — Two sizes cover the range from 50,000 to 300,000 Btu input per hour for natural and mixed gases and three sizes for manufactured gas.
MADE BY — *Norman Products Co., 1150 Chesapeake Ave., Columbus 8, Ohio*.....**S-336**

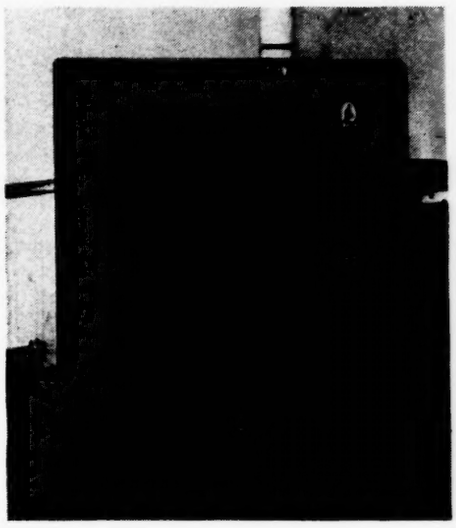
Filter Watchman

NAME—Research filter watchman.
PURPOSE—Warning signal to indicate when air filters have to be changed.

FEATURES — Mechanism measures the air flow through the filter. When the air flow is so restricted as to cause fuel waste, a small light is automatically turned on as a warning signal. The light may be located in any convenient spot. Current may be taken from the low voltage circuit used for air conditioning control or from a doorbell transformer.
MADE BY—*Research Products Corp., Madison, Wis.* **S-337**

Boiler

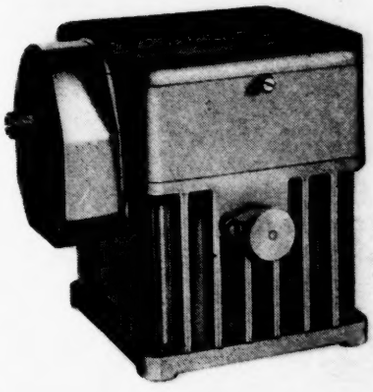
NAME—Waterborne boiler unit.
PURPOSE—Space heating for the home.
FEATURES—Large primary heating surfaces exposed to the flame are contained in this unit which is



automatically fired for steam, hot water or vapor heating. Unit contains a boiler, a built in oil burner or a stoker. An instrument panel is recessed into the side of the cabinet, and if desired, a built-in hot water coil for domestic hot water is supplied.
MADE BY—*Iron Fireman Mfg. Co., Cleveland 11, Ohio.* **S-338**

Control Motor

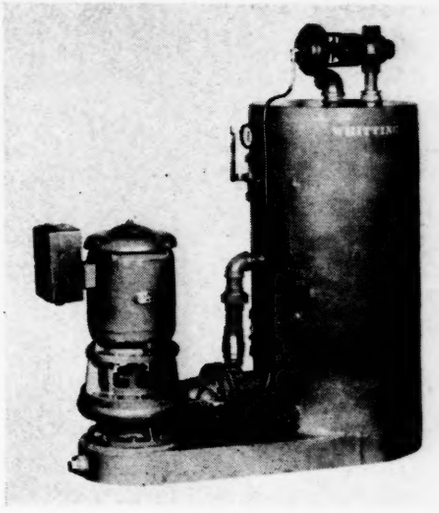
NAME — Barber-Colman oil submerged control motor.
PURPOSE—For the control of dampers used with heating, ventilating and air conditioning systems.



FEATURES—The shaded pole induction motor drives the main shaft through heat-treated reduction gears. The entire operating mechanism is completely submerged in oil and is sealed in a die cast case. Units are available with or without adjustable speed devices. Auxiliary contact cams are adjustable. Controls are built for either high or low voltage applications.
MADE BY—*Barber-Colman Company, Rockford, Ill.* **S-339**

Vacuum Process Pump

NAME—Whittington vacuum process pump.
PURPOSE — For low temperature cooking and other industrial uses where a vacuum must be maintained.



FEATURES—Above the basic unit is a vacuum volume chamber and on top is a compartment into which water is introduced at city pressure. Steam or condensibles in the air stream are condensed and drawn along with the air through a suction pipe to the lower chamber.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Whittington Pump & Engineering Co., 245 S. Meridian St., Indianapolis 4, Ind.* **S-340**

Steel Boiler

NAME—Pacific steel boiler.
PURPOSE—Steel boiler for heating large buildings, designed to facilitate erection in limited space.
FEATURES—Boiler is so constructed

that it is possible to take the unit apart as shown, pass the parts through a doorway and then assemble the boiler without further welding. Boiler thus assembled, it

is claimed, will still maintain shop and boiler insurance inspection standards.

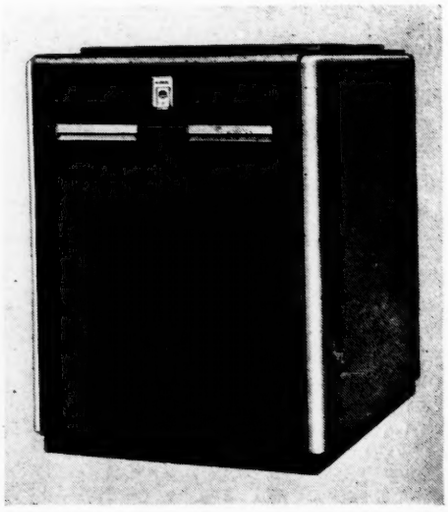
MADE BY—*Pacific Steel Boiler Division, United States Radiator Corp., Detroit, Mich.* **S-341**

Warm Air Furnace

NAME—Mohawk winter air conditioner.

PURPOSE—Space heating.

FEATURES—Burns any type of gas.



Added efficiency is secured by preheating the air in the returned air compartment before it enters the heating compartment. Controls, pipes and wire are concealed beneath the jacket but are immediately accessible by removing a front panel.

SIZES AND CAPACITIES — Nine sizes from 60,000 to 300,000 Btu.

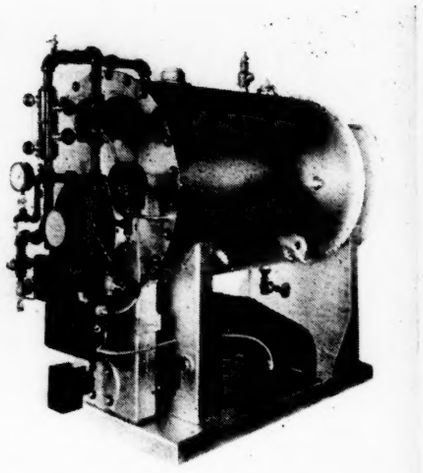
MADE BY — *American Radiator & Standard Sanitary Corp., Pittsburgh 30, Pa.* **S-342**

Steam Generator

NAME — Two-pass preferred unit steam generator.

PURPOSE—Fully automatic self-contained steam generators.

FEATURES—Compact unit with pull-through draft provides 350 lb steam per hour and is said to have an overall thermal efficiency of over 75%. Overall measurements—



length 5½ ft, width 3 ft. Units comform to ASME standards. Burner is of the preferred pressure type with a firing rate of 3 gph using No. 3 or lighter grade fuel.

SIZES AND CAPACITIES—10, 20 and 30 hp units are available.

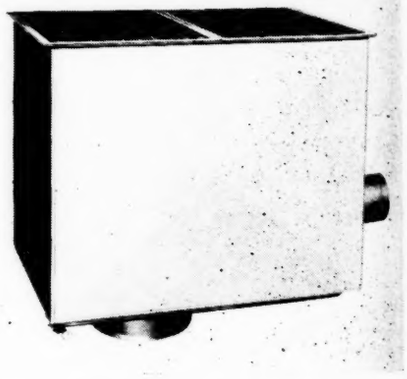
MADE BY—*Preferred Utilities Mfg. Corp., 1860 Broadway, New York 23, N. Y.* **S-343**

Floor Furnace

NAME—Coleman oil floor furnace.

PURPOSE—Space heating.

FEATURES—While automatic controls are optional, automatic draft meter is standard equipment. The



entire heating unit can be lifted out for adjustments. A long flame travel is provided around the tube.

MADE BY—*The Coleman Co., Inc., Wichita 1, Kans.* **S-344**

February, 1947

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end each item.

S-299	S-300	S-301	S-302	S-303	S-304	S-305	S-306
S-307	S-308	S-309	S-310	S-311	S-312	S-313	S-314
S-315	S-316	S-317	S-318	S-319	S-320	S-321	S-322
S-323	S-324	S-325	S-326	S-327	S-328	S-329	S-330
S-331	S-332	S-333	S-334	S-335	S-336	S-337	S-338
S-339	S-340	S-341	S-342	S-343	S-344		

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ABSTRACTS OF TECHNICAL PAPERS

On this and three subsequent pages are abstracts of the papers at the various technical sessions of the American Society of Heating and Ventilating Engineers at the Cleveland meeting, and including the two papers presented at the joint session of the ASHVE and the warm air group.

Odor Removal

Ascertaining the minimum quantity of air replenishment required for ships' berthing spaces to keep odors at an acceptable level in conjunction with air cooling, was the subject of a paper presented by William V. Consolazio and Louis J. Pecora, both of the National Naval Medical Center. Since the odor level in any space depends upon the rather large number of variables, experiments conducted by the authors were performed with a moderately tight air compartment and considerable care was exercised to reproduce the extreme conditions ordinarily encountered in berthing spaces.

In reporting odor impressions registered by the subjects, no odor was rated at 0.0; threshold odors as 1.0; definite odors, but not objectionable, as 2.0; strong objectionable odors as 3.0; very strong and disagreeable odors, yet tolerable as 4.0; and overpowering, unbearable and nauseating odors as 5.0. This concept of odor perception was in contrast to those previously used by Yaglou in which odor intensity was stated to be in accord with the Weber-Fechner law of physiological reactions. The authors stated that combinations of odors completely nullify the application of this law. Consequently, the chief distinction made in these experiments was to determine where the prevailing odors within the compartments were objectionable or acceptable.

Three different methods were used to remove or mask the odors: 1. Activated carbon was employed with a total of 80 canisters made up into four units; 2. A nationally advertised liquid deodorant containing paraformaldehyde and essential oils; and 3. Ozone, delivered according to the recommendations of the manufacturer of the ozone generating machine.

The authors concluded that: (1) The odor level for the condition of 5 cfm per man replenishment air at temperature of 78F effective temperature with respect to the transient observer was of the same order of magnitude as that for 53 cfm per man for weather air; (2) With activated carbon the replenishment air necessary for maintenance of an acceptable odor condition can be reduced considerably below 5 cfm per man. However, whether compartment leakage can be controlled so that dilution is less than 5 cfm per person is questionable, especially where large volumes of recirculated air are involved; (3) Ozone and the liquid chemical deodorant employed in separate tests did not reduce the odor level. Exposure to these substances, however, after a period of 10 min apparently exerted an anesthetic effect relative to odor perception; and (4) Carbon dioxide, carbon monoxide, bacteria, and dust did not reach objectionable or noxious levels even with greatly reduced (1 cfm per man) replenishment air.

In regard to the use of activated carbon, the authors stated that the effectiveness of carbon in air recovery was demonstrated by the fact that the compartment was no more offensive when fully occupied under conditions which permitted unlimited smoking than the thoroughly scrubbed and aired, unoccupied compartment at 1 cfm per available bunk. The effectiveness of carbon in reducing to 2.7 units an odor level that otherwise would have been 3.4 units and objectionable was shown. They concluded that a better distribution of carbon units would make this unit even more effective than it was in their tests.

Panel Heating Control

"Response and Lag in the Control of Panel Heating Systems", was the subject of a paper by F. W. Hutchinson, professor of mechanical engineering, Purdue University, devoted to a progress report of studies being made on the Housing Research campus of Purdue. The five-room residence in which the tests were made is equipped with four independent sinuous-coil type hot-water panel systems located in the floor, ceiling, exterior walls, and interior partitions. Five different methods of controlling the panel heating are installed and have been tested. All tests reported in this paper are for ceiling panels *only* and were conducted with constancy of living room air temperature as a criterion of control; if optimum comfort had been the criterion, the inside air temperature would have had to be varied as an inverse function of load.

The tests cover the following combinations of control:

1. A room air temperature thermostat controlling on-and-off operation of the gas burners in the boiler;
2. Same as (1) except that a modulating room thermostat replaced the off-and-on device and the four gas burners were actuated in sequence;
3. A room air thermostat was used with recirculation of water returning from the panels employed with parallel by-passing of a fraction of the return water so that a blend of hot water from the boiler and cool return water was used at whatever temperatures were needed to carry the load;
4. An outside temperature sensitive element replaced the room air thermostat in controlling the three-way mixing valve; and
5. The control system was actuated by outside air temperature with limit re-set from inside air temperature.

Test results reported by the author showed periodicity of panel surface temperatures for both of the control methods using off-and-on operation of the burner. The period varied with the load and with the control method, but was in the order of two hours per cycle with a change in temperatures of the surface of approximately 6F.

When control methods are used which permit regulation of energy input by blending recirculated water with boiler water at fixed temperature, the periodicity no longer occurs and stable control is, in general, realized; of three systems of this type which were tested, best results were obtained from the one using a modulating room thermostat to fix the setting of a temperature sensitive element in the discharge line from the mixing valve; this element then controlled the position of the valve.

The author reported that further control tests are under way during the present heating period using the same control methods by applying them to floor, wall and partition panels.

Tolerance to Heat

Dr. Willard Machle, New York, was the author of a paper "Human Tolerance to Heat" resulting from studies at the Armored Medical Research Laboratory at Fort Knox from 1942 to 1945. Dr. Machle stated that the ventilation, heating, and cooling of working environments is often a compromise between two opposing demands; first, to provide a working environment that will keep personnel fit to work and in satisfactory state of health; second, the requirement to maintain conditions necessitated by operations, material or equipment. Military requirements of recent years have largely determined the direction of investigations of thermal physiology. Certain of these studies bear directly upon industrial problems, and progress in the field has pointed up certain practical considerations which must enter into the design of any future investigations of human thermal exchange.

The author then referred to the thermal equilibrium concept and the

basic equation of heat balance developed at Pierce Laboratory. From this he developed a time rate approach to the equilibrium concept.

Dehumidifier Rating

Research on the problem of rating dehumidifying equipment intended for preservation of inactive vessels of the U. S. Navy was described by E. R. Queer and E. R. McLaughlin, professor and assistant professor of engineering research, respectively, Engineering Experiment Station, The Pennsylvania State College, in a paper entitled "Rating Dynamic Dehumidification Equipment."

The chief purpose of the preservation program is to economically maintain the ships in a condition of readiness for 20 years or more in the event another national emergency should necessitate their quick return to service. Dehumidification, or the removal of moisture from the air, is the major new development in this program and it is the most notable of the various specific methods employed.

In 1924 preliminary work was started by the Navy with low humidity atmospheres aboard inactive submarines to prevent the electrical circuits from grounding. In this and subsequent work it was determined that if a 30% relative humidity atmosphere could be maintained within the vessel, the deleterious effects of excessive moisture would be arrested. Recent experience with test samples of untreated and polished mild steel suspended for a prolonged period of two years in a dehumidified atmosphere of 30% relative humidity has confirmed previous results regarding corrosion. They have remained bright and perfectly free of corrosion and dust.

The recent study began in 1943, and since temperature control was not considered essential it was decided to continue with machines employing solid chemical desiccants. The main function of the machine, briefly stated, was to automatically remove water from the ship's air, pass it overboard, and return the dry air to the ship with sufficient pressure to assure adequate distribution of small quantities of air through the fire mains.

Two different methods were used to measure the performance of the dehumidifiers. One was to measure the inlet and outlet air conditions, and determine, from a giant psychrometric chart, the performance in terms of water removed. The second method was to mount the whole machine on scales, the change in weight representing change in water content of the sorbent.

Tests were run at 15, 35, and 75% relative humidity at 40, 70 and 95F dry bulb temperatures, and at 0F and 75%, the last to observe performance at low temperatures. The 35% tests were run because this is close to the normal operating condition on the ships once equilibrium is established. The 75% tests were to determine performance at the start of ship operation when the humidity is high. The 15% tests gave a third point to establish curves.

Two different types of machines were studied, one a single bed machine operating with the reactivating air flowing in the same direction through the sorbent as air to be dried, the second employing two sorbent towers, one bed being reactivated while the other is adsorbing.

In most cases other than at 0F inlet temperature, the power consumption was less than 1 kw hr per lb of water removed.

Odor Diffusion

Dr. Richard L. Kuehner, bacteriologist in the research department of York Corporation, was the author of a paper entitled "The Effects of moisture Content on the Diffusion of Odors in Air." During the past decade or so opposing views have been held as to the effect of moisture diffusion, one being that odor is stronger in dry than in moist air, the other just the reverse. The author conducted tests to determine which of these views was valid.

Five types of odors were used, as follows: (1) acetic acid, giving a human body odor; (2) methyl acetate, the odor of which is that of decomposing fruits and flowers; (3) isovaleric acid, with an odor of animal sweat and burning tobacco; (4) butyric acid, with a dairy product odor, and (5) pyridine, with the odor of decomposing meat. Measurements were made of the time required for each of these odors to diffuse to given distances from the point of injection, under combinations of conditions with 60F, 110F and 0 and 100% relative humidity. The author found that:

1. Relative humidity exerts an unpredictable effect on the ability of odors to permeate the atmosphere. Three substances tested diffused more rapidly at 100% relative humidity than at 0%; with the other two, the reverse was true;
2. Diffusion rates vary according to the difference between the vapor pressure of the air and that of the odor, and
3. The difference in rates of diffusion from 0% to 100% R.H. are so small that commercial design relative humidities from 45 to 55% or from 75F to 85F dry bulb would have no effect on the odor problem.

Suction Openings

"Nature of Air Flow at Suction Openings" was the title of a paper by Dr. Allen D. Brandt, U. S. Public Health Service, Russell J. Steffy and Richard G. Huebscher, both the last being research assistants at the American Society of Heating and Ventilating Engineers Research Laboratory. This paper was the result of research carried on at the ASHVE Laboratory in cooperation with the U. S. Public Health Service, the work being done while Dr. Brandt was assigned to the laboratory by the Health Service. It is the second progress report on in-

Newly-elected officers of the ASHVE installed at the Cleveland meeting. From left to right: president, Dr. B. M. Woods, University of California; first vice-president, Professor G. L. Tuve, Case School of Applied Science; second vice-president, A. E. Stacey, Jr., Carrier Corp.; treasurer, John F. Collins, Jr., National District Heating Association.

vestigation of air flow at suction openings.

The authors reviewed the earlier work on this subject, particularly that of Dalla Valle and Silverman. They then compared the results of the ASHVE investigation with those of Dalla Valle and Silverman and concluded that Dalla Valle's formula $Q = V(10X^2 + A)$ adequately expressed the flow relationship at unflanged suction openings. (In this equation, Q = air flow in cfm; X = axial distance in feet from face of hood; V = velocity in fpm at axial distance; A = area of hood in square feet).

The authors reported that no similar convenient and fairly accurate formula is applicable for flanged openings, but stated that the equation $Q = V \times (6X^{1.8} + A)$ may be used for flanged hoods.

Air Contaminant Concentrations

The "Methods Used in Determining the Health Hazards Arising From the Inhalation of Various Chemicals" were discussed in a comprehensive paper presented by Dr. Francis F. Heyroth, of the Kettering Laboratory of Applied Physiology, College of Medicine, University of Cincinnati. The author's objective was to acquaint ventilating engineers with the methods available for measuring the toxicity of air borne contaminants, the reliability of the data secured by the various methods most frequently employed, the manner in which agreement may be reached as to the maximum allowable concentration of a given substance, and the sources of information that are available.

The importance of securing quantitative data depends upon the recently appreciated fact that any toxic substance may be absorbed up to a certain amount without inducing detectable harm. The margin between this limit and the amounts required to induce severe or fatal injury vary widely with the nature of the toxic agent.

The author reviewed the research work done abroad as well as that by American organizations and said that for many substances, two or more standards are needed; one so low that no harm can result even when the period of exposure extends over every working day in the year, and the other, a higher one, applying only to shorter periods of exposure, such as may result from intermittent operations or from leaks in equipment.

Dr. Heyroth classified the three sources of data for setting maximum allowable concentrations as: field observations, experiments on animals, and experiments on human beings. He said that experience demonstrated that the first method has great value when used with other methods involving the experimental approach.

Regarding animal experimentation, he said that this method offers the advantage that the new toxic agent may be studied in a large range of accurately known concentrations at will, and that the experiments may be conducted for any desired period of time from minutes to months.

However, use of animal experimentation has certain limitations which are inherent in the variations in the response of individuals or different species of animals to exposure. For example, such experiments may yield not one, but a series of maximum allowable concentrations, each applicable to a different species.

According to Dr. Heyroth, human experimentation may be desirable after a sufficient background of information has been obtained from animal experiments to make it safe. It is rarely feasible to employ this method to determine a maximum allowable concentration, since this would necessitate the daily exposure of several men over prolonged periods. It is of value as a check upon the possibility that the value arrived at on the basis of animal experimentation may be grossly in error when applied to man, and added that experiments of this type are of especial value in appraising the hazards of exposure in poorly ventilated quarters and for relatively brief periods to concentrations somewhat in excess of that believed permissible for prolonged exposure.

Large Warm Air Systems

"Proposed Design Procedure for Large Mechanical Warm Air Heating Systems" was the title of a paper by S. Konzo, R. J. Martin, D. L. Levinson, and R. W. Roose, Special Research Professor, Assistant Professor, Graduate Student, and Special Research Assistant, respectively, all of the University of Illinois.

This proposed design procedure applies to structures having a design heat loss greater than 150,000 Btu per hr, and in which a wide range of values of temperature rise, static pressures and other variables are offered in place of the fixed values given in an existing design manual for smaller installations. The accepted method of calculating the heat loss was followed by laying out a proposed duct system for both the warm air and return air sides of the system. The type of register and the desired throws and deflections was specified on the layout, along with the types of fittings and the actual and equivalent lengths of each branchline from the bonnet to the register.

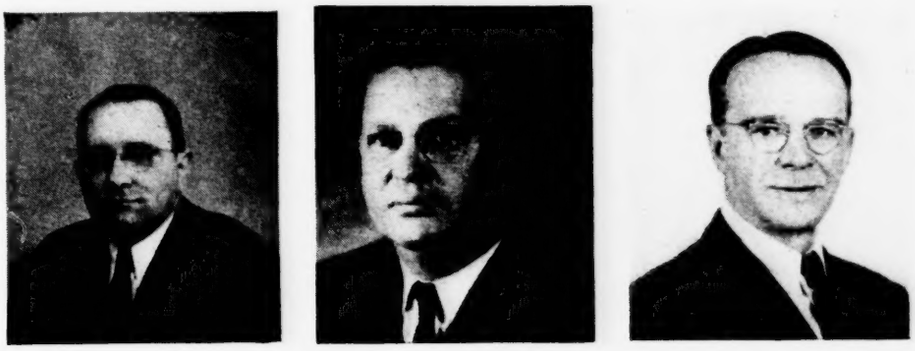
By means of an easily read table, the bonnet design temperature can be selected along with the cfm requirements for each space to be heated and their register air temperatures. A second table gave information from which to select the register size within a desired noise level range and its pressure loss based on the cfm and throw required. The duct work is then designed around the register loss and the size blower available or that is to be selected.

A step by step procedure was outlined in which a number of tables were offered for use by the heating contractor. Eventually, if the simplified proposal is adapted by the National Warm Air Heating and Air Conditioning Association, a work sheet will be prepared to itemize the separate steps in the design procedure.

Dynamic Dehumidification

"Dehumidification Methods and Applications" were described and analyzed by John Everetts, Jr., consulting engineer. He defined *static* dehumidification as moisture removal by a container of sorbent material inside the enclosure to be treated, and *dynamic* dehumidification as that where air is circulated through a sorbent material automatically reactivated to maintain a continuous predetermined condition.

The sorbents are either solid or



New officers of the National Warm Air Heating and Air Conditioning Association, elected at Cleveland are, left to right, president, F. E. Mehrings, Meyer Furnace Co.; first vice-president, (not shown), Atlee Wise, The Wise Furnace Co.; second vice-president, C. S. Franke, American Furnace Co.; George Boeddener, secretary of the Association.

liquid, the former including silica gel, activated alumina and activated bauxites for static dehumidification, and silica gel and activated alumina for dynamic demumidification. Among the liquid sorbents are lithium chloride and glycol, both important dynamic sorbents.

In discussing mechanical refrigeration as compared with use of sorbents for dehumidification, Mr. Everetts said that if electrical energy is used to regenerate the sorbent as well as operate the mechanical refrigeration equipment then refrigeration is favored over a rather wide range of dehumidification applications. However, if steam is used for regeneration of the sorbent and electric power is most practical for the refrigeration equipment, then dehumidification by sorbents is the more economical.

For a typical case, with entering air at 95F dry bulb, electric refrigeration, electric power at 1 cent per kw hr and steam at 30 cents per 1000 lb, using steam for regeneration and with supplementary electrically-operated mechanical refrigeration where required, mechanical refrigeration is more economical than the sorbent method only when the delivered dry bulb is 70 or lower and the entering dew points are above 65F. All other conditions show the sorbent method to be more economical.

The author concluded that the use of mechanical refrigeration is not very promising for dehumidification for most industrial and commercial applications unless steam is not available for sorbent regeneration.

A third method of attack on the moisture problem in such applications as warehouses, is to use heat to raise the dry bulb temperature in the space and reduce the relative humidity to the desired level. This is not dehumidification in any sense of the word because moisture has not been removed from the air.

According to Mr. Everetts, the development of new sorbent materials and the more efficient use of sorbents is making dehumidification an industry comparable to those of heating, refrigeration and air conditioning.

Germicidal Radiation

Descriptions of (1) two new types of air samplers for collecting air-borne bacteria and determining their concentrations, (2) results obtained in sampling air in various locations, and showing the bacteria per cubic foot of air and (3) the results of certain germicidal installations, were covered in a paper entitled "Determining and Reducing the Concentration of Air-Borne Micro-Organisms." The authors were Matthew Luckiesh, director, and A. H. Taylor, physicist, both of General Electric's Lighting Research Laboratory.

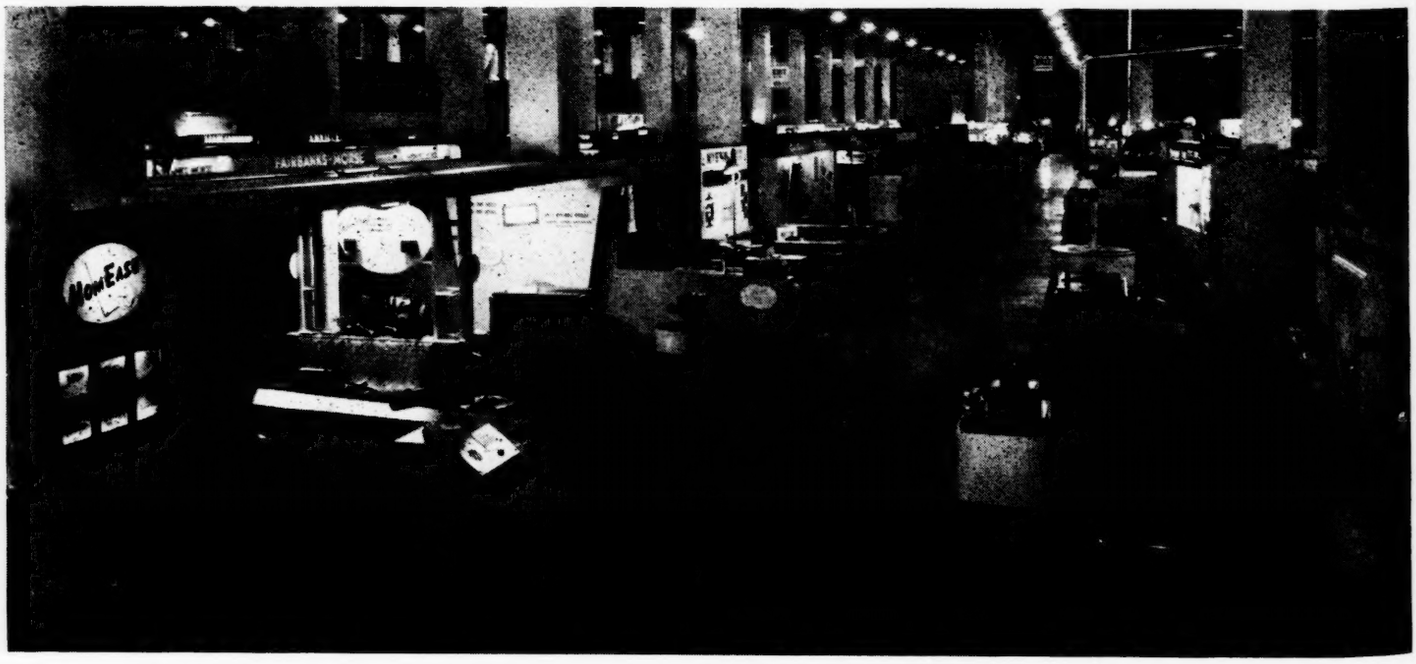
The authors found that there are many bacteria in dust on the floor and this is important since activity on the part of the occupants stirs the air and shows a great concentration of bacteria at this time.

One of the most important possible places of infection by air-borne bacteria is the reception room of almost any doctor, where prospective patients wait for periods which may be one hour or longer.

Tests were also conducted on the effectiveness of germicidal lamps in a number of locations. The authors reported that in some of the better installations the following results were obtained: three schools, reductions of 45, 50 and 65%; dairy farm, cow barn, 55%; calf barn, 70%; poultry house, 75%. In several cases negative results were obtained; *i.e.*, the concentration was greater when the lamps were on than when they were off. Obviously this result was due to factors which overshadowed the lethal effect of the lamps. In two schools where the tests showed the lamps to be ineffective the number of lamps installed was less than recommended. In a nursery having a low ceiling the lamps were installed only about 1 ft below the ceiling. This clearance is too small for effective irradiation.

The authors reported that the most efficient installation will be one which concentrates the maximum amount of energy in the upper air of the room, projecting it across the room so as to produce lethal dosages throughout the volume of air irradiated. If too much of the energy strikes the ceiling the installation will be inefficient for too much of the energy will be absorbed without irradiating a large volume of air. Circulation of air in the room is essential for the irradiated upper air must return to the lower occupied region in order to reduce the concentration of organisms in the breathed air. The maximum amount of energy which can be used in an occupied enclosure is limited by the permissable intensity of reflected energy reaching the eyes of persons in the room. Tentatively the safe values appear to be 0.5 and 0.1 microwatt per square centimeter for 8 hour and 24 hour occupancy, respectively.

If germicidal lamps of adequate wattage and number are properly installed, then a worth while reduction in air-borne organisms results.



A view of a small portion of the 7th International Heating and Ventilating Exposition at Cleveland

Failure to Co-operate with the Future

T. W. REYNOLDS
Chief, Air Conditioning Division,
Abbott, Merkt & Co., Engineers, New York

The author relates many ways in which shortsightedness or unusual conditions result in inadequate or obsolescent piping which is unable to keep pace with plant growth.

ONE of the besetting sins of many industrial plants, in fact of most any enterprise, is failure to provide for the future. This may come about through lack of thought or of vision, or there may even be a selfish indifference to a situation which may find one not present when it arrives, for absence of body is better than presence of mind.

There come to mind a few instances of failure to cooperate with the future. In 1939 World's Fair at New York had the well known Perisphere, a huge ball without a toilet. Patrons viewed the wonderful scene below from the revolving platform inside the ball and though the scene depicted The World of Tomorrow, there was said to be no need for a washroom in a structure where patrons came and went within a space of four minutes. And there were to be no workmen within the space between the inner and outer shells from which lighting effects were directed. However, there were workmen and many of them around these lights, but the descent to other buildings was of too protracted a nature for nature itself. The huge concrete basin at the fountain below could not very well be dug up for a sewer, so the inner space between the two shells with all its vast ramifications soon developed its own atmosphere. It was even suspected that the air conditioning fans were sometimes used in an unusual way.

The Perisphere was not to be heated. It was a summer affair. Be that as it may, the foresight of one individual procured the laying of a substantial gas main through the courtesy of the Gas Company just in time before the concrete of the basin was poured. The end of the main was terminated at one of the supporting columns. Artists produced The World of Tomorrow, but as cold weather came, skill of fingers was deadened by numbness. However, their cry for heat was soon satisfied by the Gas Company who extended the gas line to gas unit heaters within the ball, which heaters they rented to the Fair. A tarpaulin was placed overall just above the working space to avoid heating the entire World and while the gas fumes were not all that might be desired, the atmosphere was better than within the two shells and the workers of the World were content.

It has long been a practice for some engineers to foresee the inevitable and specify the heavier weights in certain sizes of pipes for underground usage and even for concealed services. True, that where corrosion is accelerated, the additional wall thickness is of doubtful value, but for most cases its use seems commendable, since the cost in place is but slightly affected. Even as the writer pauses to gaze thoughtfully upward in his lofty skyscraper office, there appears overhead a hole in the ceiling of the set back, a hole growing bigger with the days and the number of workmen trying to find the cause of the trouble, altogether forming a timely incident which seems in keeping with the subject in hand.

Today the answer was found, the reason why water came down on a thoroughly wet day from a ceiling light fixture whenever the writer pulled the chain to this fixture. The workmen have just removed from the hole a horizontal section of galvanized steel leader pipe installed 17 years ago with the seam at the top all corroded away just above the light fixture. What had added to the puzzlement heretofore had been the absence of leakage from the pipe when left exposed on drizzly days, but with plenty of leakage as soon as the hole was closed up and a good downpour came along, during which time there was enough water to fill the bore of the horizontal pipe and to flow out of its corroded top.

Had this horizontal piece been of greater wall thickness, would it have lasted proportionately longer? Possibly so; the writer has his limitations and knows not. But he does know that never before has he been sprinkled when pulling a chain to that kind of fixture. Never before has he seen corrosion of this type in the top of a pipe where water runs less often than in the bottom. And never before has he seen corrosion of any type in a leader pipe.

Many short cuts in piping layouts were learned during the war, for one could not wait for machinery layouts, let alone their detailed location and sizes of outlets for their various piping services. The quickest way and what finally proved the safest bet was a pipe line for each service as run down each bay with at least one outlet per bay. In this way, engineering was quickened and its cost lessened. In like manner it was found that pipe sizes could be guessed as to possible minimum or maximum. Selection of top sizes were then quickly made with savings in engineering cost at least as great as any saving in material that might have been realized in some cases by calculating the precise size.

Exterior piping for an extensive group of ammunition plants was estimated in one day and carloads of pipe were soon on their way. Each service was laid out separately on tracing paper without regard to the other. Each was quickly sized in a liberal manner and with a factor of safety, since it was realized that pipe of certain sizes cost the same to lay and connect. Then the several layouts were laid over one another and co-ordinated in the same trench with the service

most important, or juggled about in a give and take to find a common trench. And sometimes the longest way round for some particular service gave the least cost, considering trenches and the service as a whole. Likewise the running of pipes within a structure may best be determined, not by the least amount of pipe, but by grouping for hangers, scaffolding and concentration of labor. Appearance is of course best served in this manner.

Of course, right now, the customary material for a particular service has undergone some strange quirks, according to the job, its location and the time when needed. When one foregoes the specifying of non-corrosive pipe for corrosive drainage, due to contemplated scarcity, and is therefore content with ordinary cast iron pipe, he may be surprised if later during construction the usual is not obtainable and that the special pipe is. Aluminum sheets all of one gauge were quickly gathered for ducts on one job before the supply was exhausted. The additional cost of aluminum over galvanized iron was $15,000 and had to be taken all in the heaviest gauge. Specifications, in this case, mean nothing as to lighter gauges being suitable for the smaller ducts.

A leading manufacturer of valves has in recent times published a number of very useful charts showing the correct use of valves for each kind of service. These charts are good business, but they are true requirements and helpful reminders to the busy engineer of just where valves are needed. In general, they show us that too often have we avoided the use of pipe for by-passes which at some future time might well have saved costly shut downs.

In the usual industrial plants, drains and any other services, laid below floors or in hung ceilings, should be spaced at regular intervals with plugged outlets provided at strategic points. Every attempt should be made in these days to provide a reserve even beyond the contemplated future with its expansion and shifting of departments, or even change in quality and/or kind of product. Buildings may extend vertically or horizontally to any points of the compass, except on street or fixed property lines, as many a department store has learned to its sorrow. As a rule, air conditioning units and other services in department stores have been placed on other than permanent walls. It is desirable when changes are made to see that such units (together with their connecting chilled water risers) are established on store walls which are fixed in permanence by the streets they abut.

So the engineer should consider many things about the future when designing. If it is an industrial plant, a compressed air main to the new building may not be thought necessary, but where services go underground it is well to lay it now and as a rule compressed air is finally required. Are all of the important main services in duplicate? This is the practice of the Ford Co. Are there sill cocks all around the exterior? No one carries water today and lawns and flower gardens usually are planned for most modern plants. Are the water lines and condensate returns amply sized to decrease pumping costs and the last named arranged for inclusion of all possible future return of the pure water of condensate and its contained heat? Are mains provided and with outlets for attachment of portable units for spot heating where occasional or temporary production may take place? Avoid now the later interference that may come about with existing ducts, conduits, piping, machinery and structure designed with no thought of piping which might later be run. Structures of today are closely built with no space for unthought of utilities.

Need one point out that it costs money to tear down hung ceilings and break into masonry of walls and floors, to pump condensate overhead when floors can not be torn up and to add a lot of additional piping, insulation and valves because of afterthoughts. All of these add to the collection of dust, crowd the plant, tend to lessen housecleaning throughout the plant, detract from appearance and light, both natural and artificial, and oppress one as they bear down on headroom. Thermal losses of distribution, pick up load, operation and depreciation are all increased. Maintenance is also increased due to more piping, insulation, and valves, and joints to keep tight. Heat from additional piping and lighting add to discomfort and lost time and as a rule result in increasing first the thickness of insulation, next the addition of fans to stir up the heat and finally more fans to remove the heat.

Hidden costs of engineering, accounting and discussion go up as changes are made. Work around existing interferences becomes involved, must be done in steps and at overtime rates, or under operating conditions, while employees idle during shut downs or while watching the work.

Residences relatively of minor importance in the way of structures, collectively become of magnitude. Are there sill cocks each side of the house, a riser or risers to the attic which may some day be heated. Are there two bath rooms or at least roughing in for a second bath. The writer only put one in the house he planned to finish his days in, but for reasons of no detriment to the house desires now to sell. In ten years one's desires are apt to change, but a house of fair proportions does not sell so well when equipped with only one bath.

The steam piping is down in the basement. If it is a new house, will there be several circuits for good balancing, or one long drawn out affair? The saving made by the latter method is of no consequence and is usually offset by the contractors lost time in his attempts to balance and adjust the system with consequent loss of good will and non-repeat orders, or no recommendation to others. Expensive equipment is only rendered more or less useless by niggardly saving on piping. A contractor who does poor work must work entirely on a price basis, risk a lot of capital for a small profit, and estimate many jobs he does not get. Such a contractor is on his way out.

Unfortunately, today there appears a tendency to discount the future, as well as a tendency to care but little about things of lasting quality. There was a time when one required that a pair of shoes last three years, but now there are many who would rather have three pair of shoes during the same three years.

NEWS OF THE MONTH

BATTLE OF THE FUELS

renewed in fury as coal strikes, gas overloads, new processes throw weight into fray.

Coal is still the dominant fuel, but its position is increasingly jeopardized by the switching to other fuels for economic, service, or convenience reasons on the part of railroads, power companies, industrial, and domestic customers. With assurance of coal supplies, accelerated coal burning research, and diminishing resources of other fuels, this trend may be reversed in the long range future; according to a *Business Week* report.

• **STATISTICS.** — For instance, in 1940 only 1% of freight was carried under power other than coal. In 1946 12% was so carried. Actually, these figures are relative since the railroads used 60 million tons of coal in 1946, against 52 million tons in 1940.

All but 7% of utilities fuel in other than hydroelectric plants was coal in 1920. In 1946, this figure jumped to 22%. The 51.6% of electric power, including hydroelectric, which was derived from coal in 1945 dropped to 49% in 1946. Federal Power Commission statistics show that coal accounted for 51.6% of all power in 1945, oil 3.5% and gas 3.3% with water power accounting for 35.9% of the power produced.

Similarly, domestic heating installations using other than coal jumped from 22.5% in 1940 to 73% in 1946.

U. S. Bureau of Mines reports the following trends in mineral fuels production in 1946 against 1945:

Oil (Crude production)	+ 1.2%
(All oils demand)	— 1.3%
Natural gas	+ 4%
Bituminous coal	— 8.6%
Anthracite	+ 10%
Coke	— 14%

• **GASIFICATION.**—Preliminary results of gasification tests of rice and barley anthracite in an oxygen-blown Wellman-Galusha gas producer at Consolidated Mining and Smelting Company of Canada, Ltd., were optimistic. Dr. C. C. Wright of Pennsylvania State College concludes that anthracite can be satisfactorily gasified with oxygen and steam to yield a raw synthesis gas for use in making synthetic ammonia, methanol and gasoline.

Underground gasification experiments at the Gorgas Mines of Alabama Power Company (H&V:12:46:p116) have been resumed with Bureau of Mines cooperation. In this experiment a peninsular coal vein is cut off from the main deposit and two 6-ft tunnels driven in approximately 30 ft apart to 150 ft depth connected at the deep end to form a U-shaped chamber. The coal will be ignited in the cross tunnel and a blower will circulate air in the U system while the gases produced will be collected and used as fuel in the power company's steam electric plant one mile distant. The use of oxygen in this system would boost production about 50%.

• **OXYGEN.**—A key to commercial gasification of anthracite and other coals may be found in the increasing production of low cost oxygen. A $15 million plant in Brownsville, Texas will use the Hydrocol process and produce oxygen in quantity for its own use. The *Wall Street Journal* says that American industry will bet about $100 million in new plants that cheap oxygen will be a commercially important and profitable item. Plants are planned by Standard Oil of New Jersey, ($30 million), Standard Oil of Indiana ($30 to $45 million), Gulf Oil, Air Reduction, Koppers and others. Mass produced oxygen will sell at about $3.00 a ton (23,500 cu ft) compared to a present cost of about $70.00 per ton when oxygen is purchased by the cubic foot. Cheap oxygen can be used in the manufacture of steel and in conversion of natural gas to gasoline, as well as in the gasification of coal and lignite.

• **RESEARCH.**—Further evidence that coal is not ready to give up without a struggle is seen in an appropriation by Bituminous Coal Research of $447,000 in their budget for research for 1947. This is in addition to gas turbine locomotive research (H&V:1:47:p91) and is higher by $72,200 than the 1946 allotment. These funds are voluntary contributions by coal companies, associations, railroads and equipment manufacturers. Projects in 1947 will include six on railroad utilization, 15 on residential, 8 on industrial steam and non-steam, two on mining and preparation.

Secretary of the Interior J. H. Krug announced on January 10 that, following the unanimous recommendation of the Advisory Committee of the Anthracite Research Laboratory, a site in the city of Hazleton had been selected for the Bureau of Mines' new $450,000 research laboratory. The site, consisting of a 20 acre tract with actual building expected to start before the end of the government's current fiscal year on June 30, 1947. When completed the Federal Laboratory will be manned by approximately 30 engineers and technical assistants who will conduct research work on mining, preparation and utilization of anthracite.

• **GAS LOAD.**—The seasonal load factor and popularity of residential gas heating is giving some gas producers trouble. Long Island Lighting and Brooklyn Union Gas, according to a *New York Times* report, fear a pressure drop in cold weather should the temperature remain for any considerable period below 10F. Brooklyn Union is building two $10 million additions to its facilities to handle a 33% increase in number of house heating customers and 10 to 15% increase in commercial users in 1947. The number of new customers added by Long Island Lighting in 1946 is equal to all former customers.

• **CASE FOR OIL.** — The case for oil has been ably stated by G. T. Kaufman, technical secretary, Oil Heat Institute, speaking before the Management Division of the Real Estate Board of New York. Mr. Kaufman pointed out that oil at 6½c a gallon is equivalent to coal at $10.66 a ton on the basis of Btu's delivered. This figure does not take into account either the cost of conversion (Oil-to-coal conversion is expensive, too, says Mr. Kaufman) or economies other than in fuel consumption.

Building for coal, says Mr. Kaufman, traditionally locates boiler and operating space in expensive areas of the building. Coal storage and ash removal space are also items to be considered. Mr. Kaufman contends that if oil burner efficiency is maintained with periodic gas analyses and flue temperature control, the responsiveness, cleanliness, economy and other advantages in the use of oil make it the logical fuel for large buildings.

Mr. Kaufman emphasized the misleading character of the oft-quoted statistics of our diminishing oil supply. Present reserves, he says, are 20 billion barrels. These are "touchable" reserves in present drillings and are sufficient for 14 years' supply. On the same basis, he points out our natural resources in zinc will last only 19 years, gold 14 years, lead 12 years, aluminum 9 years, antimony 4 years, silver 11 years, while tungsten, platinum, mercury, asbestos, manganese and nickel are virtually exhausted already. These are Bureau of Mines figures. Mr. Kaufman says that our supplies of oil will be augmented by secondary methods of extraction (such as water flooding), by new drillings, discovery of new formations, and new methods of extraction of oil from oil shale. The latter item alone, he says, would supply our needs for 65 years.

• **PROTOTYPE BURNER.**—The need for a standard means of determining the burning qualities of fuel oils has resulted in the construction of the first combustion comparator, to be known as the Combustion Reference Test Unit, Oil-Heat Institute of America announced following the regular quarterly meeting of its board of directors in New York.

In times past it has been possible to determine the burning qualities of fuel oils by analyses of their chemical and physical properties. But present day oils having almost identical properties by analysis may have quite different burning qualities. Nowadays to tell how an oil will burn it must be burned, and heretofore this has been troublesome because there have been no standard burning tests or burning apparatus. There was need for a standard apparatus in which to burn the oil to be tested, prescribed conditions under which to conduct the burning tests, and a scale to measure how well or how poorly the oil burned. It is this need that the Combustion Reference Test Unit will fill.

First expression of the need for a standard of fuel-oil burning quality was made several years ago by Dr. Leslie C. Beard, Jr. of Socony-Vacuum Oil Company. He said he thought great good would be accomplished if burner manufacturers could design and build a standard burner for testing the suitability of oils for burning in various types of burners. The burner manufacturers picked up this suggestion and turned it over to the Engineering Committee of Oil-Heat Institute, where a subcommittee was appointed to design and build such a unit. The subcommittee produced the Combustion Reference Test Unit, and they have found in their preliminary tests that they have created not only a means for testing the burning qualities of fuel oils but a means also for making comparative tests of the performance characteristics of various oil burner component parts. Such comparisons they found could readily be accomplished by running parallel tests of known and unknown parts using identical oils of known specifications. To develop this unit to its fullest extent the Directors of Oil-Heat Institute have voted to appropriate additional funds to employ an independent research laboratory to explore all possible fields of usefullness for the unit, and to prescribe procedures for its proper use as a fuel oil testing apparatus and a burner parts comparator. It is anticipated that when its possible uses have been fully established the unit will have wide acceptance by all organizations having to do with the production, marketing, testing and burning of fuel oils as well as producers of equipment.

• **SOLAR HEAT.**—Massachusetts Institute of Technology has been authorized by CPA to build an experimental house for research in solar heat and heating homes with heat from the sun, and to obtain solar heat storage data.

The M.I.T. solar house is designed as a one-story structure with a flat, sloping roof no basement, and an extremely large window area. M.I.T. describes the project as "part of a research program for heating homes with only solar energy, to save critical materials and fuel by eliminating conventional type heating systems. Data obtained in experiments this winter will be of value in solar housing design."

The roof and floor of the building will be insulated with eight inches of rock wool. Wall space that is not taken up by big double glazed windows of clear glass will be insulated with four inches of rock wool.

ATOMIC LABORATORY

to be built at Schenectady, New York. Industrial use of atomic power seen as nearer realization.

The War Department has announced plans for the establishment of a $20 million nuclear research laboratory near Schenectady, New York, for the study of power generation from atomic energy.

Major General L. R. Groves, Chief of the Manhattan Project, stated that the General Electric Company, under a contract made several months ago, would operate the nuclear power research center and is serving as the prime contractor for design and construction

• **FOURTH.** — "Named The Knolls Atomic Power Laboratory, this will be the fourth in the network of laboratories established by the Manhattan Project to further nuclear research," said General Groves. "The work on this program began many months ago and will be transferred to the Atomic Energy Commission as a part of the broad peacetime development program.

"The Clinton Laboratory at Oak Ridge and the Argonne National Laboratory at Chicago are already carrying out broad research programs, with both educational institutions and industrial organizations participating. Work has been started on the Brookhaven National Laboratory on Long Island, which will be operated by a corporation formed by nine of the major eastern universities.

• **SCOPE.** — "Research work in all phases of atomic power development will be carried on in the Knolls Atomic Power Laboratory. In addition research on specific problems in connection with the operation of Hanford Engineer Works, operated by General Electric's Chemical Department will be carried out in the new facility."

Land for the Knolls Atomic Power Laboratory will be provided by General Electric Company adjoining the site of the huge new General Electric Research Laboratory now under construction where the company's fundamental research in other fields will be concentrated. Although the two laboratories will be operated together, the Government-sponsored Atomic Power Laboratory will be separate from the General Electric Research Laboratory.

• **SUPERVISION.**—Dr. C. G. Suits, vice-president and director of research for GE, will have general supervision of the nuclear study program. Responsibility for the atomic power pile project, which is the principal activity of the new government sponsored laboratory, has been assigned to Dr. Kenneth H. Kingdon, senior General Electric physicist who with Dr. Pollock was one of the first physicists to work on the isolation of Uranium 235. Dr. Kingdon has been with the General Electric Research Laboratory since 1920 where his chief work has been on electron emission, radio tubes, thyratrons, and in recent years on nuclear research. He worked at Berkeley with Dr. E. O. Lawrence in the development of the Electro-Magnetic Plant for separation of uranium 235. During both World War I and World War II Dr. Kingdon made large contributions in the anti-submarine field.

• **FIELDS.**—"Basic nuclear reactions and the theory of uranium fission are in the field of physics," said Dr. Kingdon, "but the detailed study of the problems of construction of an atomic power reactor for power production involves major contributions from chemistry, chemical engineering, metallurgy, electrical and mechanical engineering.

"For this reason, scientists specializing in these fields will compose a considerable proportion of the group working on the new program. In addition, the resources of the many engineering divisions of the General Electric Company will be employed on the project. The General Engineering and Consulting Laboratory under Vice-president D. C. Prince will undertake an extensive engineering activity on atomic power plants. This work is being coordinated with the research program by Mr. C. W. LaPierre."

• **CONSULTANTS.**—Dr. Suits announced that a number of scientists who played important roles in the earlier work of the Manhattan Project have been retained by General Electric as consultants for this work. Among these are: Dr. Hans A. Bethe, Cornell University; Dr. Glenn Seaborg, University of California; Dr. E. O. Lawrence, University of California; Dr. W. Zinn, Argonne National Laboratory; Dr. Warren K. Lewis, Massachusetts Institute of Technology; and Dr. Eugene P. Wigner, research director, Clinton Laboratories, on leave from Princeton University.

• **FACILITIES.** — In addition to chemical, physical, metallurgical, and chemical engineering laboratories, special facilities are planned in the new Atomic Power Laboratory. Among these are a uranium reactor for the experimental production of atomic power, powerful atom smashers, and a "hot" chemistry laboratory, where the reactions involving radiation from radioactive materials may be studied.

• **STAFF.**—Dr. Suits reports that about 450 scientists and some 1600 technicians will be required when the combined activities of the two laboratories are in full operation. A number of scientists from other laboratories of the Manhattan Engineer District have already joined the General Electric staff, and additional physicists, chemists, metallurgists and engineers will be added to the project in the immediate future.

As part of the nuclear research program a branch of the company's research laboratory has been established at Richland, Washington in the Hanford Engineer Works of the Manhattan Project. Dr. W. D. Coolidge, formerly director of the General Electric Research Laboratory has taken charge of this laboratory at Richland.

Administration of the contract with the General Electric Company and coordination of the work at the Knolls Atomic Power Laboratory with other Manhattan Project work will be accomplished by the Schenectady Area of the Manhattan District. Mr. L. E. Johnston, who has been with the Corps of Engineers since 1934 and was a wartime officer with the Manhattan Project has been appointed Area Engineer.

• **OUTLOOK.**—Discussing the outlook for atomic power in industry, H. R. Austin, president of The M. W. Kellogg Company, process engineers and industrial plant builders of Jersey City, N. J. and New York, N. Y., said in a recent statement; "It is reasonable to assume that there will be practical applications of atomic power in industry within the foreseeable future. Many problems, of course, remain to be solved and the task is one that requires the combined cooperative efforts of both scientists and engineers."

• **CLINTON PILE.** — Examining these problems, Mr. Austin reviewed the major current developments in this direction at the Clinton Laboratories, Oak Ridge,

Tenn., in which his company's wartime subsidary, The Kellex Corporation which engineered the K-25 plant at Oak Ridge, Tennessee, a major source of Uranium 235 for the atom bomb. is playing an important role. He pointed out that the Clinton Laboratory, operated by The Monsanto Chemical Company for the Manhattan District has under way a program of pile research which it is expected will lead to the development of an experimental power pile and a research pile. The latter will permit the study of fundamental nuclear phenomena and the stability of materials and their operating pile conditions both of which are essential factors in the development of a commercial power pile.

Because of its wide engineering experience on the K-25 plant at Oak Ridge, the Kellex Corporation was chosen to cooperate in the development of the research pile and has the responsibility for translating the basic information developed by the scientists and engineers of Clinton Laboratories into the final engineering design. The magnitude of this task will make it necessary for the Kellex Corporation to employ a complete engineering staff at the Clinton Laboratory.

• **N. E. COUNCIL.** — Atomic energy is held possible within five years, in the opinion of the Atomic Energy Committee of the New England Council, which has been conducting an extended investigation of the subject. And it recommends the use of Federal funds to aid research, calling it "one kind of government financing that we cannot afford to curtail, whatever may be the national policy along general lines of retrenchment and economy.

This new source of power should be particularly attractive to certain types of industry needing great quantities of heat according to the committee which believes that electric power can be produced from atomic piles at a cost comparable with that of the most modern high pressure steam central stations, and that with further research and development eventual cost may go well below present production costs. The committee is headed by William Webster, vice-president of the New England Power Association, Dr. Karl T. Compton, president of Massachusettes Institute of Technology, Bradley Dewey, president of the American Chemical Society, Frederick S. Blackall, Jr., president of the Taft-Pierce Manufacturing Company, and Chester M. Alter, dean of the Boston University Graduate School.

GLYCOL VAPORS

and ultraviolet radiation still in experimental stage as air disinfectants, USPHS officer warns.

Dr. R. E. Dyer, Director of the National Institute of Health, U. S. Public Health Service, has issued the following statement on the use of glycols and ultraviolet radiation in the control of airborne infections, to answer numerous inquiries from the public:

• **WIDE INTEREST.** — During the past few months, several articles have appeared in the public press relative to the possible efficacy of glycol vapors and ultraviolet radiation in reducing certain infectious diseases, particularly upper respiratory diseases, such as the common cold. Due to the fact that many inquiries have been made as to the possibility of using one or both of these methods in public buildings, it is felt that a statement at this time should be made concerning the use of such installations.

• **NOT CONCLUSIVE.** — Committees of the National Research Council and the American Public Health Association have studied and reviewed the data on such installations. Within the past several weeks, these two committees separately have submitted reports. Both of these committees feel that the use of either glycol vapors or ultraviolet radiation is still purely in the experimental stage and that the data collected so far do not warrant the installation of such equipment in public buildings and industry in the hope of cutting down upper respiratory infection. The U. S. Public Health Service, through its research organization, the National Institute of Health, has conducted rather extensive studies of both glycol vapors and ultraviolet radiation and fully concurs in the reports and recommendations made by the committees of the National Research Council and the American Public Health Association. It must be emphasized that direct unshielded ultraviolet radiation of sufficient intensity to kill microorganisms in the air is also harmful to the eyes and exposed skins of humans. These observations are not intended to indicate that the future will or will not disclose new public health values in the application of either glycols or ultraviolet radiation. Much experimentation is needed, however, before a decision can be made as to whether such application may or may not be warranted.

POLLEN STUDY

of United States to combat hay fever.

A research council to study pollen distribution throughout the nation in an effort to help hay-fever sufferers is being set up by the American Academy of Allergy.

• **PLAN.**—The plan calls for the formation of three major divisions to deal with aeroallergens, foods and drugs, and pharmaceuticals. The first subject to be studied will be aeroallergens—air-borne substances causing allergies. Sub-committees will deal with four major divisions of allergens—pollens, molds, dust and miscellaneous allergens, and air processing.

• **MAP.**—Among the projects the sub-committees will prepare will be a daily pollen-count map to be made in cooperation with the United States Weather Bureau. The map will be offered to newspapers for publication.

The academy has allocated $1,000 for initial administrative expenses of the new group. Additional financing will be sought from foundations and private contributors.

NEWS OF EQUIPMENT AND MATERIALS

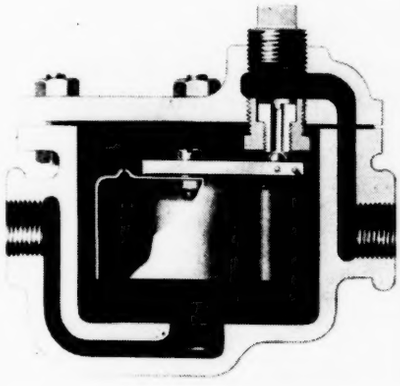
NOTE: New equipment introduced at the 7th International Heating and Ventilating Exposition is described elsewhere in this issue.

Steam Trap

NAME—Hoffman series 600 inverted bucket trap.

PURPOSE—To drain condensate from a steam line.

FEATURES — All working parts are connected to the bonnet and are removable with it for servicing,



without breaking the pipe connections. Bucket and lever arm and seat are of brass while the body and bonnet are of gray iron. By a simple change in the size of valve seat, it can be adapted to various pressures. Straight through pipe connections permit close to floor installations.

MADE BY—*Hoffman Specialty Co., 1001 York Street, Indianpolis 7, Ind.* **270**

Pump Drive Motor

NAME—GE tri-clad induction motor.

PURPOSE—Vertical motor designed specifically for pump drives.

FEATURES—A controlled system of lubrication permits the proper amount of oil to flow through bearings. Bearings are protected from rust during standby periods because the oil level is above the top of the balls. Bearings, punchings and windings are cooled by a double-end ventilation system which draws in air at both ends of the motor and discharges it through openings in the stator frame. Adjustment of the pump shaft is accomplished by means of the locking nut on top of the coupling. Rotor windings in all ratings are said to provide suitable

starting torque with low starting current needed for full voltage starting. Complete rotor is dynamically balanced to reduce vibration and bearing wear. Hollow shaft designed to be rigid.

SIZES AND CAPACITIES—Available in ratings from 1 to 500 hp and at all speeds and frequencies.

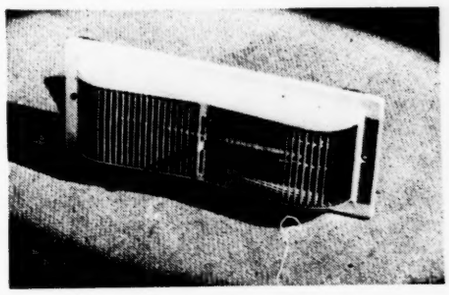
MADE BY — *General Electric Co., Schenectady, N. Y.* **271**

Register

NAME—Minneapolis-Honeywell air conditioning register.

PURPOSE—Air outlet for use with domestic forced warm air heating systems.

FEATURES — Manual shut-off con-



trols the air supply volume at the register. Air is claimed to be evenly distributed over the entire face of the register. Register has a curved extension front and adjustable diffusion vanes so that air can be distributed in any room regardless of shape. An operating lever projecting through the center is used to change the amount of opening of the volume control blades. Makers claim that need for balancing dampers in duct work has been eliminated.

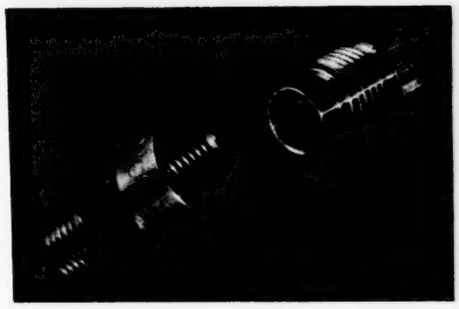
MADE BY — *Minneapolis-Honeywell Regulator Co., 2753 4th Ave. S., Minneapolis 8, Minn.* **272**

Tube Coupling

NAME—Uniflare tube coupling.

PURPOSE — For joining lengths of tubing.

FEATURES—Plain end tubing is in-



serted in the fitting and made up in the conventional manner. Tube is self-extruded and self-flared by the wrench action in bringing the coupling together.

SIZES AND CAPACITIES — In sizes from $\frac{1}{8}$ to $\frac{3}{4}$ in.

MADE BY—*Brockway Co., Naugatuck, Conn.* **273**

Adhesive

NAME—Du Pont No. 4665 cement.

PURPOSE—Industrial adhesive.

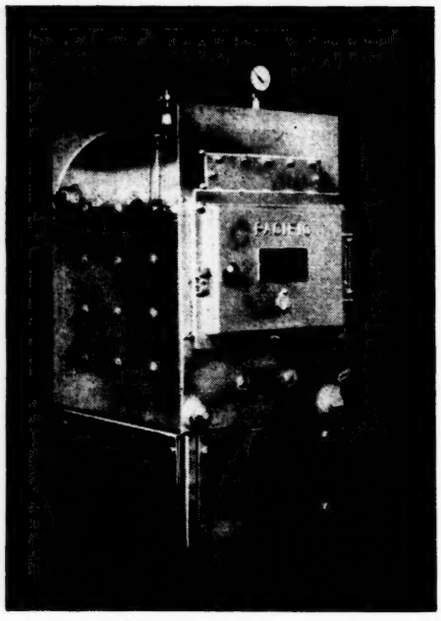
FEATURES—Adhesive is said to be tough and flexible and suitable for bonding metal coils and metal sheets, to wood, plastics, vulcanized synthetic and natural rubbers. Although insoluble in water, its bond strength is lowered by the continued immersion. However, original bond strength is gained after removal from water. Dried adhesive film is resistant to dilute alkalies, acids and corrosive salt solutions.

LITERATURE AVAILABLE — Booklet A-6031.

MADE BY — *E. I. du Pont de Nemours and Co., Inc., Finishes Div., Wilmington 98, Del.*..... **274**

Boiler

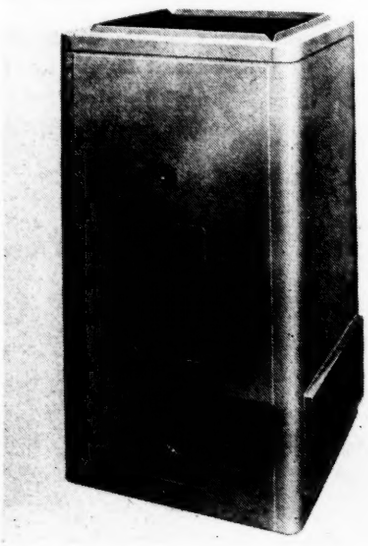
NAME—Pacific Plate-Flue boiler.
PURPOSE—Oil or gas fired boilers for home heating.
FEATURES—This boiler is an improved design of the Pacific square boiler. Door on this unit has been enlarged and relocated. Boilers may be used for steam, vapor or hot water heating. Plate flues are constructed of ¼ in. flange boiler plate. Units may be furnished with tankless or tank type built in domestic hot water heater.



SIZES AND CAPACITIES — SBI net steam rating of 400, 550, 700 and 900 sq ft.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*United States Radiator Corp., Detroit 31, Mich.* 275

House Furnace

NAME — Evans 377-G oil burning furnace.
PURPOSE — Automatic, gravity circulation type furnace for basement installation.
FEATURES — Furnace is equipped with injection jet vaporizing pot type burner. Low and high fire rings are removable. Low fire and pilot fire are controlled by an electrically operated switch. Combustion chamber has a built-in flame baffle. Furnace has two cold air inlets 1 x 2 ft on the right and left located near the floor. Warm air outlet at the top is 2 x 2 ft. Con-



struction has been engineered to permit knocked down shipment in two packages. Furnace burns No. 1 or 2 fuel oil.
SIZES AND CAPACITIES—Unit has a gross output of 74,000 Btu per hour.
MADE BY — *Evans Products Co., 15310 Fullerton Street, Detroit 27, Mich.* 276

Gas Tubing

NAME—Carbo-Flex gas tubing.
PURPOSE—Flexible gas tubing with easily connected coupling.
FEATURES — Tubing comes with Wiggins quick coupling at both

ends or at either end, as desired. Tube is connected by a quick pull-push; another quick-pull, and it is disconnected. Tubing has a heat and acid resistance neoprene lining. The outside may be ordered in stainless steel, monel, bronze, brass, copper, aluminum or other metals. Couplings are available in aluminum or stainless steel.
SIZES AND CAPACITIES—¼, ⅜, ½, ⅝, ¾, 1, and 1¼ in., in standard lengths of 1 to 6 ft. Other lengths on order.
MADE BY — *Carbo-Flex Hose Co., 5452 Vineland Ave., North Hollywood, Calif.* 277

Welding Kit

NAME—Ergolyte Junior.
PURPOSE — Portable lightweight welding kit.
FEATURES—Unit is capable of doing light welding, soldering and brazing. Welder is built to operate on

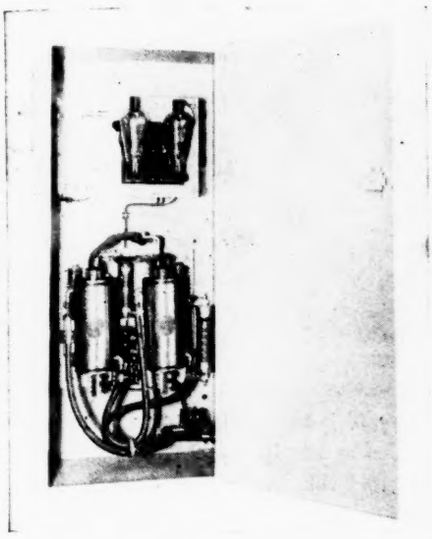
110 volt a-c and is fused to 30 amperes. A special holder serves as an electrode holder and also as a ground cable for metallic arc welding or as an electric torch for brazing, soldering and welding of nonferrous metals. The equipment with the case weighs 38 lb.
MADE BY—*Ergolyte Manufacturing Co., Philadelphia, Pa.* 278

Corrosion Inhibitor

NAME—Morpholine.
PURPOSE — For treating feedwater to check corrosion.
FEATURES — Chemical is an alkali that controls acidity due to free carbon dioxides in the feed water or carbon dioxide resculting from decomposition of soluble carbonates. Any desired alkaline value can be obtained by adjusting the concentration in the boiler.
MADE BY — *Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York 17, N. Y.* 279

Welding Control

NAME—G-E non-synchronous resistance welding control.
PURPOSE — Equipment designed to meet NEMA standards for resistance welding controls.
FEATURES—New line has been developed to include combination of ignitron contractors and sequence-weld timers with or without electronic heat control and all mounted in a single cabinet. Control station is within easy reach of operator



when the unit is mounted on the welder. The use of industrial type relays, cabled wiring, and plug-in timing panel and accessories is said to simplify servicing and to provide greater flexibility. The electronic heat control results in stepless adjustment of the welding current.
MADE BY — *General Electric Company, Schenectady, N. Y.* **280**

Pipe Gauge

NAME—G. E. thickness gauge.
PURPOSE—For measuring the thickness of iron or steel pipe from the outside of the pipe.
FEATURES—Unit consists of an indicating instrument, a gauge head, and a saddle which is connected to the gauge head by two screws. A different saddle is required for each diameter of pipe. Instrument measures average thickness of a pipe over an area of several square inches. Dirt, scale and paint on

the inside of a pipe do not add to the thickness reading. Instrument operates on 115-volt, 60 cycle.
SIZES AND CAPACITIES—Type MS-A can be used on pipes from 1 to 2 in. diameter and pipe thicknesses up to ¼ in.
MADE BY — *General Electric Co., Schenectady, N. Y.* **281**

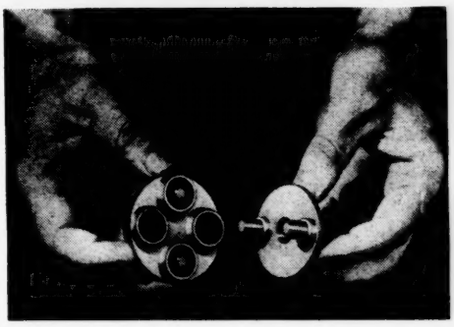
Motor Drive

NAME—Link-Belt Electrofluid drive.
PURPOSE — A motorized-hydraulic combination of drive to overcome conditions of inadequate torque and excessive starting current.
FEATURES—Makers claim that drive permits motor to gain speed smoothly and rapidly under low

torque. Should the driven machine become stalled, the drive will pull to the maximum torque capacity of the motor thereby drawing enough current to cause the thermal overload protective device to function. The fluid traction coupling absorbs the energy of the motor rotor and protects the driven machine from shock due to sudden stopping. Shock loads from the driven side are said to be smoothed out.
LITERATURE AVAILABLE—Book No. 2085.
MADE BY — *Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.* .. **282**

Power Coupling

NAME—Morflex coupling.
PURPOSE — Low power takeoff of fractional horsepower drives.
FEATURES—Coupling uses the Neo-



prene biscuit assembly which shields machine from shock and permits slight angular misalignment of shafts while transferring maximum power. Coupling does not require lubrication. Maximum speed is 3,600 rpm.
SIZES AND CAPACITIES—Two sizes for handling 3 and 9 foot-pounds torque. Weight is ½ and 1¼ lb respectively. Choice of bore is from ¼ in. on the smaller size to 1 in. on the other.
MADE BY—*Morse Chain Company, Detroit, Mich.* **283**

Glazing Material

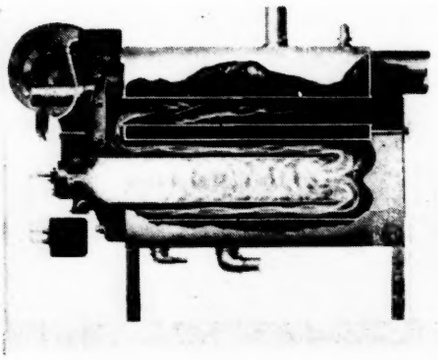
NAME—Richglaze.
PURPOSE—Glazing material.
FEATURES—A lightweight cord net is laminated between two sheets of cellulose acetate. It is said to have long life when exposed to weathering out of doors. One suggested use is safety glazing under glass skylights to stop falling glass. Comes in rolls 36 in. wide.
MADE BY—*The Richkraft Company, Chicago, Ill.* **284**

Heating Unit

NAME—Econolux 150-V.
PURPOSE — Packaged heating unit for the home.
FEATURES — Unit has a Bankhead pressure type burner. Hot gases back up through 13 2-in. I.D. heavy duty fire tubes. A double jacket encircles almost the entire outer surface of the main boiler. The extra shell forms a separate compartment for domestic hot water. Designed for hot water systems, it is said to be suitable for homes of 4 to 10 rooms. Boiler is 24 in. in diameter and 60 in. high.
MADE BY—*S. T. Johnson Co., Oakland, Calif.* **285**

Packaged Boiler

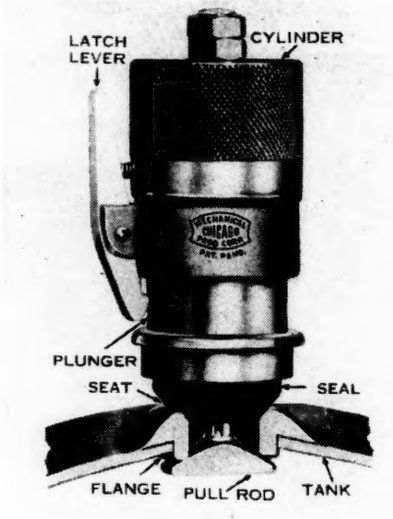
NAME—Whirl-O-Magic.
PURPOSE—Space heating.
FEATURES—Unit comes as a complete packaged heating plant and includes boiler, oil burner device, all assembled and wired. Atomized oil is sprayed through the combustion head and mixes with air. Flame whirls through a combustion tube that is brought up to incandescent heat. By means of a counter current gas flow, combustion tube is kept at a constant operating temperature. Hot gases pass to stainless steel fire tubes. Controls are accessible by removing the front panel section.
SIZES AND CAPACITIES—Three sizes



—model 3 for heating up to 6 rooms; model 2 for heating up to 9 rooms; model 1 for a 12-room house.
MADE BY—*Persiro Mfg. Corp., 275 Jefferson St., Newark 5, N. J.* .. **286**

Test Plug

NAME — Hydro-Matic self-sealing test plug.
PURPOSE—Plug for use in closing openings in tanks or other vessels when undergoing internal pressure tests.
FEATURES—Testing-pressures from within the tank are utilized to force and hold the seal against its seat. An oversized tapered head on the pull rod centers itself against the inside edge of tank openings and sets up a positive resistance to the pull exerted within the cylinder when forcing the seal against its seat. Plugs are adaptable to any type of spudded, flanged or drawn openings, either threaded or plain.
SIZES AND CAPACITIES—Available for standard pipe openings from ½ to 2 in.
MADE BY — *Mechanical Products Corp., 168 No. Ogden Ave., Chicago 7, Ill* **287**



Vibration Control

NAME — No. 140 series vibration eliminator.
PURPOSE—For absorbing shock and eliminating the transmission of vibration.

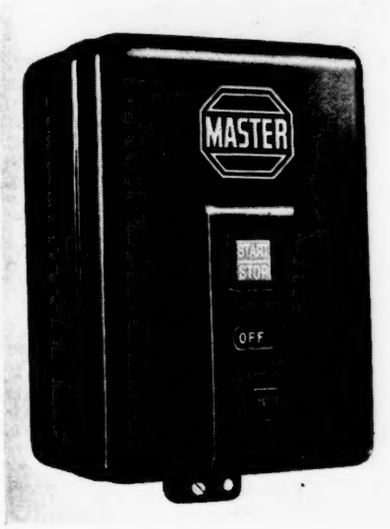
FEATURES — By varying the hardness of the rubber, this unit is available for loads between 100 and 400 lb. At these loads, it is said that a static deflection as great as ½ in. can be obtained.
MADE BY—*The Vibration Eliminator Co., 10-28 47th Avenue, Long Island City 1, N. Y.* **288**

Steam Humidifier

NAME—Humid-O-Matic.
PURPOSE—Humidification by steam.
FEATURES — Adjustments can be made by turning a small screw at the top of the unit. Humidifier will diffuse up to 20 gal of water in 24 hours with 5 lb pressure and larger models will diffuse up to 100 gal. Air is prevented from entering the system when steam pressures drop below atmospheric pressure. It shuts off when condensate cannot return fast enough to prevent overflowing. Surplus condensate is returned to supply line against higher pressure.
MADE BY—*Skilbeck Mfg. Co., Distributed by Techtmann Industries, 714 West Wisconsin Ave., Milwaukee 1, Wis.* **289**

Motor Starter

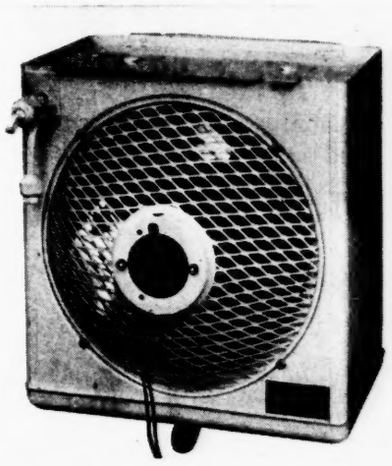
NAME—Master motor starter.
PURPOSE—Push button control for starting and stopping motors.
FEATURES—All terminal and mounting screws are easily accessible from the front. Enclosure has ad-



equate knockouts and ample space is provided for wiring. Overload relays provide protection against excessive motor currents. Relays are of the bimetal type.
SIZES AND CAPACITIES — Standard voltage ratings are 115 and 230 volts for single phase, and 110, 208, 220, 440 and 550 for polyphase motors.
LITERATURE AVAILABLE — Bulletin 200.
MADE BY—*The Master Electric Co., Dayton 1, Ohio.* **290**

Water Defrost

NAME—Flocold.
PURPOSE—Refrigeration of walk-in boxes and similar applications at or above 34F, with electrical or water defrost for low temperature work.
FEATURES—Designed for easy installation, unit has balanced primary and secondary heat transfer surface, die-formed fan guard and motor support (four smallest sizes only), Neoprene drains. Freon and methyl units are equipped with d-h Hexchanger heat exchangers. Ammonia units are also manufactured.
SIZE AND CAPACITIES—Units come in 13 sizes ranging from 91 to 2,700



Btu per F temperature difference.
MADE BY — *Drayer-Hanson, Inc., Los Angeles 21, Calif.* **291**

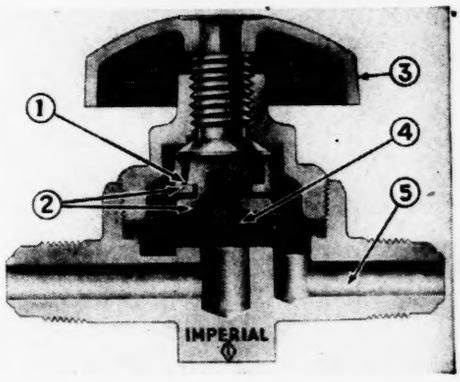
Tube Cleaner

NAME—Roto air jet.
PURPOSE—Tube cleaning.
FEATURES—Power developed by the air jet motor is so much greater than that required for tube cleaning, that it is necessary to throttle

the air supply. Unit has only two moving parts, a shaft and a blade. The egg shape bore in the cylinder is said to assure close contact between both opposite edges of the blade and cylinder, resulting in maximum utilization of air.
SIZES AND CAPACITIES — Available for most common tube sizes.
MADE BY — *Elliott Co., Roto Division, 145 Sussex Ave., Newark 1, N. J.* **292**

Refrigeration Valve

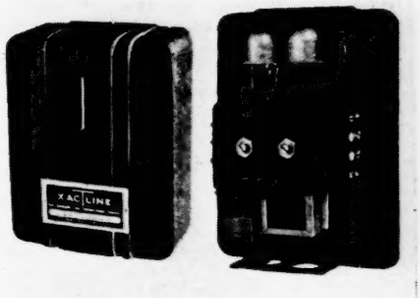
NAME—Imperial DiaSeal valve.
PURPOSE—For use as a refrigeration diaphragm valve.
FEATURES—Illustration shows: 1. direct lift, to provide positive control with flow in either direction; 2. construction with only two moving parts; 3. quick opening and closing by less than two turns of handle; 4. diaphragm impervious to all common refrigerants; 5. inlet and outlet ports in line. Internal parts lift out with the bonnet and simplify soldering valve in the line.



Valve body is made of a brass forging. Valve is available in two-way and angle types, with either flare or solder connection.
MADE BY—*The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7, Ill.* **293**

Temperature Control

NAME — Xactline temperature control.
PURPOSE — Instrument to provide close temperature-variation control.
FEATURES — Makers claim that instrument has attained variation as



low as 0.2F and power on-off cycles as short as three seconds. Unit is housed in a cast aluminum case 8¼ x 6¼ in. wide and 3 in. deep. Control is achieved without the use of rotating mechanical parts.
LITERATURE — 4-page folder.
MADE BY — *Claud S. Gordon Co., 3000 S. Wallace Street, Chicago 16, Ill.* **294**

Air Eliminator Valve

NAME—J-2 Risselt air eliminator.
PURPOSE—Air venting one or two-pipe steam heating systems.
FEATURES — Valve is made in two pieces and employs the use of ther-

mos bellows as the activating member of the unit. Unit can be disassembled for cleaning. Valve is made of brass and is intended for use where the boiler pressure is less than 15 lb per sq in.
MADE BY — *Risselt Division, The Lodge & Shipley Machine Tool Co., 800 Evans Street, Cincinnati 4, Ohio.* **295**

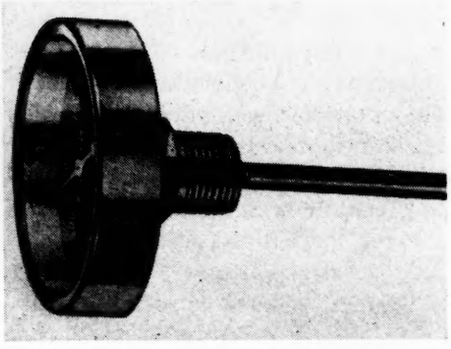
Gas Burner

NAME—Chore Boy gas burner.
PURPOSE — Residential type gas burner for use with hot air, hot water and steam heating plants.

FEATURES—Pilot is located in direct contact with the burner for instant ignition. Pilot is visible through furnace door and is claimed to be easily removed for cleaning. Pilot flame plays on a thermocouple which energizes an electric magnet as a safety factor in the event of gas failure. Gas pressure regulator reduces main line pressure of 6 in. water column to 3½ in. for constant pressure. Burner is so designed that flame from single large burner is directed to the walls.
MADE BY—*Standard Fuel Engineering Co., 673 Post Ave. S., Detroit 17, Mich.* **296**

Thermometer

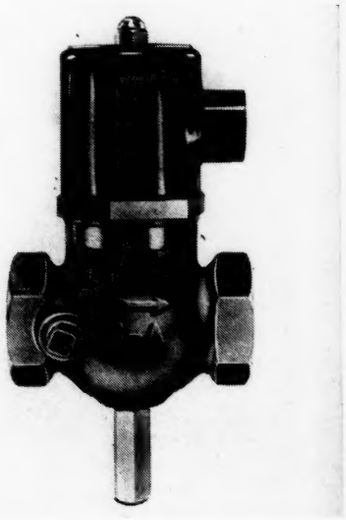
NAME—Dillon stainless steel thermometer.
PURPOSE—Measurement of temperature.
FEATURES — Stainless steel industrial thermometer has calibrations in either Centigrade or Fahrenheit. Makers guarantee an accuracy of 1% for the range of the scale.



SIZES AND CAPACITIES—Dials 3 and 5 in. diameter. Ranges from 0-200, 50-500, 150-750 and 200-1000F.
MADE BY—*W. C. Dillon & Co., 5410 W. Harrison Street, Chicago 44, Ill.* **297**

Gas Valve

NAME—Model SG No. 1 magnetic gas valve.
PURPOSE — To control the flow of gas in domestic heating systems, conversion gas burners, water heaters, and other gas fired units.
FEATURES—Valve can be used with any 2-wire snap action room ther-



mostat. Valve should be used with a 115/25-volt transformer and should be installed in a vertical position. An arrow on the side of the valve indicates the direction of flow through the valve. A ½-in. conduit opening is provided to permit the installation of BX or conduit, if desired. Provision is made for manual operation in the event of prolonged power failure.
MADE BY — *Gleason-Avery, Inc., Auburn, N. Y.* **298**

February, 1947

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

270	271	272	273	274	275	276	277	278	279
280	281	282	283	284	285	286	287	288	289
290	291	292	293	294	295	296	297	298	

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Degree-Days for December, 1946

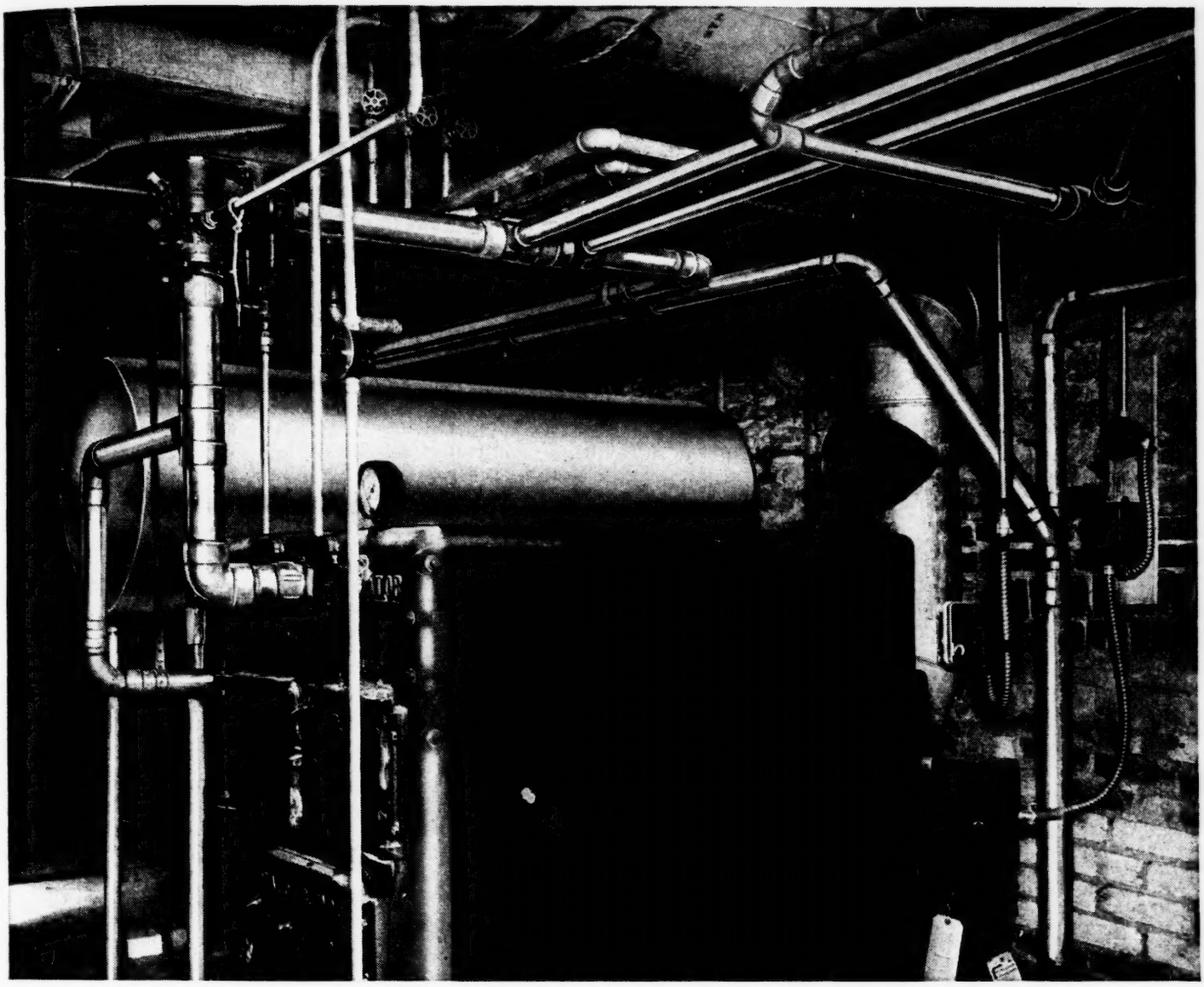
HEATING AND VENTILATING's 20th Year of Publication of Monthly Degree-Day Data

City	December			Cumulative, September 1 to December 31			Heating Season[1]
	1946	1945	Normal	1945-46	1944-45	Normal	Normal
Abilene, Texas	458	674	592	830	1063	925	2061
Albany, New York	1134	1354	1147	2240	2726	2439	6580
Albuquerque, New Mexico	763	982	924	1752	1833	1827	4298
Alpena, Michigan	1223	1302	1247	2668	2959	2951	8299*
Anaconda, Montana	1767	1274	1238	3534	3196	3171	8357**
Asheville, North Carolina	696	977	837	1325	1811	1689	4232
Atlanta, Georgia	487	829	639	812	1323	1131	2890
Atlantic City, New Jersey	719	981	893	1276	1694	1753	5176
Augusta, Georgia	418	704	549	630	1046	886	2161
Baker, Oregon	998	1151	1156	2938	2815	2815	7163
Baltimore, Maryland	699	980	874	1223	1669	1664	4533
Billings, Montana	1107	1278	1194	3007	2892	2816	7119
Binghamton, New York	1017	1263	1156	2028	2551	2515	6808
Birmingham, Alabama	500	798	595	830	1279	913	2352
Bismarck, North Dakota	1505	1740	1553	3633	3873	3514	9192
Block Island, Rhode Island	811	1026	884	1527	1936	1736	5788
Boise, Idaho	893	1056	1011	2494	2352	2285	5552
Boston, Massachusetts	940	1133	1026	1746	2156	2130	6045
Bozeman, Montana	1110	1331	1293	3291	3253	3286	8521**
Buffalo, New York	1037	1277	1104	2032	2599	2372	6822
Burlington, Vermont	1209	1417	1287	2490	2975	2773	7514
Butte, Montana	1223	1377	1261	3707	3479	3183	8272
Cairo, Illinois	636	983	822	1139	1660	1499	3909
Canton, New York	1272	1483	1342	2634	3127	2994	8020
Charles City, Iowa	1207	1550	1390	2588	3194	2895	7588
Charleston, South Carolina	313	571	425	435	816	632	1769
Charlotte, North Carolina	538	823	679	912	1331	1220	3120
Chattanooga, Tennessee	626	907	694	1090	1516	1225	3118
Cheyenne, Wyoming	944	1217	1144	2847	2875	2889	7466
Chicago, Illinois	960	1254	1074	1870	2429	2172	6077
Cincinnati, Ohio	767	1131	927	1368	2025	1796	4684
Cleveland, Ohio	960	1190	1060	1814	2280	2185	6155
Columbia, Missouri	807	1195	985	1540	2136	1896	4922
Columbia, South Carolina	409	728	561	644	1086	916	2364
Columbus, Ohio	881	1192	1017	1619	2193	2020	5398
Concord, New Hampshire	1235	1391	1234	2550	2923	2732	7353
Concordia, Kansas	921	1255	1050	1939	2277	2019	5315
Dallas, Texas	397	668	567	717	967	870	2256
Davenport, Iowa	1004	1373	1175	1966	2658	2333	6289
Dayton, Ohio	937	1275	1014	1771	2406	1947	5264
Denver, Colorado	790	1006	1017	2219	2261	2276	5874
Des Moines, Iowa	1038	1414	1215	2143	2658	2370	6384
Detroit, Michigan	1019	1250	1113	1964	2491	2332	6490
Devils Lake, North Dakota	1672	1917	1710	3990	4339	3871	9970
Dodge City, Kansas	821	1120	1004	1878	2056	1952	5035
Dubuque, Iowa	1078	1419	1243	2217	2853	2534	6790
Duluth, Minnesota	1588	1652	1519	3563	3787	3489	9483
Eastport, Maine	1191	1266	1228	2560	2856	2890	8520**
Elkins, West Virginia	903	1198	1035	1950	2400	1950	5697
El Paso, Texas	555	607	617	1051	1029	1038	2428
Ely, Nevada	1084	1254	(a)	3192	3069	(a)	(a)
Erie, Pennsylvania	906	1162	1039	1714	2256	2164	6273
Escanaba, Michigan	1321	1379	1344	2937	3195	3138	8771*
Evansville, Indiana	749	1113	862	1471	1984	1545	4244
Fort Smith, Arkansas	531	889	707	1020	1421	1177	3147
Fort Wayne, Indiana	1001	1314	1138	2014	2621	2211	5925
Fort Worth, Texas	412	672	574	725	924	826	2148
Fresno, California	602	538	577	1172	925	911	2334
Galveston, Texas	203	327	270	322	394	330	1016
Grand Junction, Colorado	1003	1226	1162	2362	2387	2278	5548
Grand Rapids, Michigan	1025	1229	1147	2015	2582	2397	6535
Green Bay, Wisconsin	1312	1466	1324	2723	3166	2882	7825
Greensboro, North Carolina	664	963	760	1215	1683	1395	3529
Greenville, South Carolina	535	868	738	928	1428	1334	3380
Harrisburg, Pennsylvania	887	1117	992	1689	2132	1981	5375
Hartford, Connecticut	1013	1270	1060	1930	2457	2157	6036
Hatteras, North Carolina	350	626	493	491	897	727	2571
Havre, Montana	1400	1528	1383	3675	3523	3314	8700
Helena, Montana	1204	1352	1245	3458	3216	3058	7898
Houston, Texas	212	396	335	354	504	449	1157
Huron, South Dakota	1312	1632	1431	3111	3372	3085	8004
Indianapolis, Indiana	852	1205	1017	1574	2220	2002	5298
Jackson, Miss.	385	646	(a)	610	978	(a)	(a)
Kansas City, Missouri	807	1216	1008	1558	2097	1886	4956
Kewanee, Illinois	994	1318	1118	1987	2456	2311	6139
Knoxville, Tennessee	647	929	781	1164	1585	1483	3670
La Crosse, Wisconsin	1293	1568	1311	2744	3285	2778	7322
Lander, Wyoming	1082	1472	1419	3190	3369	3075	7947

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with nine exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, Sioux City, and Jackson, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill.; Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, and H. M. Ludlow, Box 1368, Jackson, Miss., respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on Page 122]



Trouble always costs more than REVERE COPPER WATER TUBE

If a red light flashed the instant a leak started in a water or heating line, the cost of repairs might be minor. But the first sign of a leak is usually wet plaster, soaked furniture, ruined decoration. And leaks are only one kind of trouble. Rusty tap water, inadequate flow, faulty circulation due to rust-filled lines . . . these call for major repairs.

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Made for heating, water supply, air conditioning and other services in all types and sizes of buildings, Revere Copper Water Tube is rust-proof and has a smooth gun-barrel interior finish that insures an unrestricted flow of water through the lines. Joints made with either soldered or compression fittings help further to cut down friction loss. This tube is stamped with the Revere name and the type at regular intervals. Look for these identification marks—they insure full wall thickness and the close gauge tolerances so essential for tight sweated joints.

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Degree-Days for December, 1946 (Concluded)

HEATING AND VENTILATING'S 20th Year of Publication of Monthly Degree-Day Data

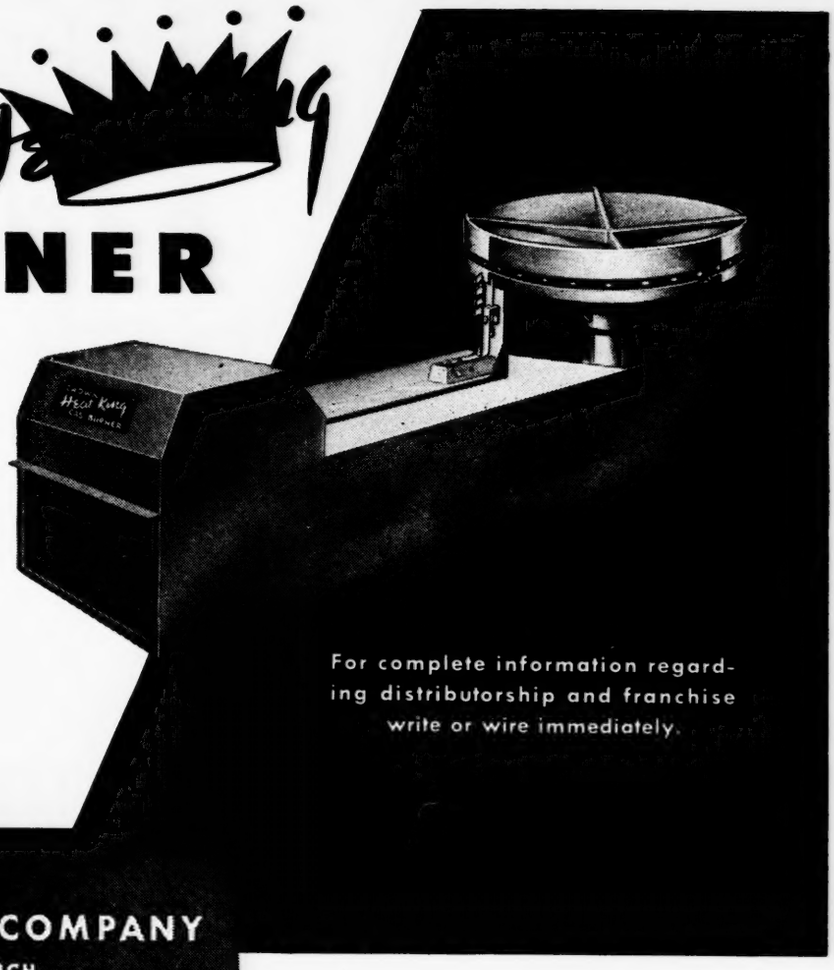
City	December			Cumulative, September 1 to December 31			Heating Season[1]
	1946	1945	Normal	1945-46	1944-45	Normal	Normal
Lansing, Michigan	1080	1303	1209	2202	2786	2665	7048
Lewiston, Maine	1254	1394	1295	2663	3041	2837	7707
Lincoln, Nebraska	992	1333	1132	2066	2428	2201	5999
Little Rock, Arkansas	491	838	651	945	1353	1079	2811
Livingston, Montana	1038	1196	1117	3116	2899	2731	7205
Los Angeles, California	266	246	301	531	413	424	1504
Louisville, Kentucky	708	1031	849	1295	1794	1587	4180
Lynchburg, Virginia	698	1004	800	1306	1781	1557	3980
Macon, Georgia	431	711	567	693	1086	897	2201
Madison, Wisconsin	1181	1465	1321	2428	3037	2758	7429
Marquette, Michigan	1324	1359	1302	2925	3195	3054	8693*
Memphis, Tennessee	510	862	663	926	1420	1127	2950
Meridian, Mississippi	427	662	549	695	995	883	2160
Milwaukee, Wisconsin	1153	1349	1221	2395	2752	2601	7245
Minneapolis, Minnesota	1376	1602	1404	2966	3332	2941	7850
Modena, Utah	969	1163	1168	2660	2570	2672	6562
Montgomery, Alabama	360	657	496	540	965	769	1884
Nantucket, Massachusetts	846	1015	905	1698	1925	1912	5957
Nashville, Tennessee	597	953	744	1071	1632	1363	3507
New Haven, Connecticut	954	1182	1017	1801	2273	2109	5895
New Orleans, Louisiana	196	404	301	275	510	403	1024
New York, New York	832	1057	940	1442	1896	1856	5274***
†Nome, Alaska	1544	1679	1509	3221	3479	3379	14580**
Norfolk, Virginia	512	819	685	821	1264	1195	3350
North Head, Washington	662	639	654	1934	1904	1785	5452**
North Platte, Nebraska	1004	1328	1173	2459	2578	2486	6366
Oakland, California	514	468	496	1207	1056	1099	3143**
Oklahoma City, Oklahoma	604	903	815	1150	1433	1379	3613
Omaha, Nebraska	1029	1416	1175	2141	2602	2284	6131
Oswego, New York	1060	1255	1138	2077	2565	2494	7088
Parkersburg, West Virginia	774	1091	921	1439	1989	1830	4775
Peoria, Illinois	988	1346	1150	1945	2632	2323	6109
Philadelphia, Pennsylvania	776	1026	884	1319	1798	1699	4737***
Phoenix, Arizona	289	430	425	584	621	581	1405
Pittsburgh, Pennsylvania	897	1110	967	1672	2100	1949	5235
Pocatello, Idaho	995	1237	1181	2752	2835	2649	6655
Portland, Maine	1187	1328	1159	2504	2918	2605	7218
Portland, Oregon	656	699	729	1749	1643	1724	4469
Providence, Rhode Island	915	1122	1026	1693	2113	2130	6015
Pueblo, Colorado	885	1175	1029	2306	2362	2164	5514
Raleigh, North Carolina	543	872	694	938	1385	1253	3234
Rapid City, South Dakota	1133	1326	1172	2979	2911	2701	7118
Reading, Pennsylvania	860	1092	1001	1562	2023	2014	5389
Red Bluff, California	568	573	(a)	1121	1050	(a)	(a)
Reno, Nevada	923	977	973	2506	2266	2284	5892
Richmond, Virginia	626	945	763	1100	1564	1380	3695
Rochester, New York	1069	1304	1125	2084	2644	2414	6732
Roseburg, Oregon	697	618	719	1890	1546	1741	4428
Roswell, New Mexico	632	742	808	1306	1372	1510	3484
Sacramento, California	587	547	574	1155	954	996	2653
St. Joseph, Missouri	881	1268	1079	1732	2270	1960	5161
St. Louis, Missouri	746	1130	936	1363	1976	1738	4585
Salt Lake City, Utah	908	1091	1020	2425	2383	2149	5555
San Antonio, Texas	306	444	347	509	624	473	1202
San Diego, California	246	239	288	507	412	487	1645
Sandusky, Ohio	947	1215	1063	1743	2283	2142	6208
San Francisco, California	424	380	428	1022	881	949	3264**
Sault Ste. Marie, Michigan	1398	1495	1370	3123	3494	3247	9285**
Savannah, Georgia	297	544	397	474	785	598	1490
Scranton, Pennsylvania	988	1196	1085	1905	2375	1016	6129
Seattle, Washington	719	684	719	1915	1727	1869	4934**
Sheridan, Wyoming	1158	1255	1320	3086	2957	3198	8008
Shreveport, Louisiana	353	638	499	636	950	769	1938
Sioux City, Iowa	1187	1518	1265	2641	2999	2583	6898
Spokane, Washington	1000	1092	1057	2765	2647	2583	6355
Springfield, Illinois	873	1234	1039	1687	2250	2002	5373
Springfield, Missouri	742	1109	893	1489	1977	1674	4428
Syracuse, New York	1067	1313	1172	2128	2647	2491	6893
Tacoma, Washington	747	737	756	2095	1941	1951	5181**
Terre Haute, Indiana	845	1179	992	1556	2168	1840	4872
Toledo, Ohio	1021	1306	1079	1996	2558	2189	6077
Topeka, Kansas	828	1224	1008	1657	2111	1883	4969
Trenton, New Jersey	842	1079	930	1495	1969	1760	4933
Utica, New York	898	1398	1144	1991	2855	2537	6796
Valentine, Nebraska	1118	1387	1245	2793	2892	2725	7039
Walla Walla, Washington	801	933	896	2108	1964	1909	4808
Washington, D. C.	724	989	896	1250	1730	1741	4626
Wichita, Kansas	776	1137	955	1583	1947	1783	4673
Williston, North Dakota	1522	1733	1591	3745	4031	3658	9323
Winnemucca, Nevada	943	1051	953	2625	2475	2353	6427**
Yakima, Washington	965	1014	1091	2633	2274	2428	5599

(a) Data not available.
†Nome data are for November.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

CROWN Heat King GAS BURNER



Designed and manufactured by heating engineers to give the best in heat and the ultimate in performance.

The low initial cost, the simplicity of installation and operation, the high fuel efficiency, compactness and beauty makes the "Heat King" an easy seller to the thousands of potential gas conversion burner users throughout the country.

The "Heat King" is built in two sizes to fit any type furnace thus assuring maximum efficiency for every installation.

Sales are easy because the low price and economical operation fit any budget.

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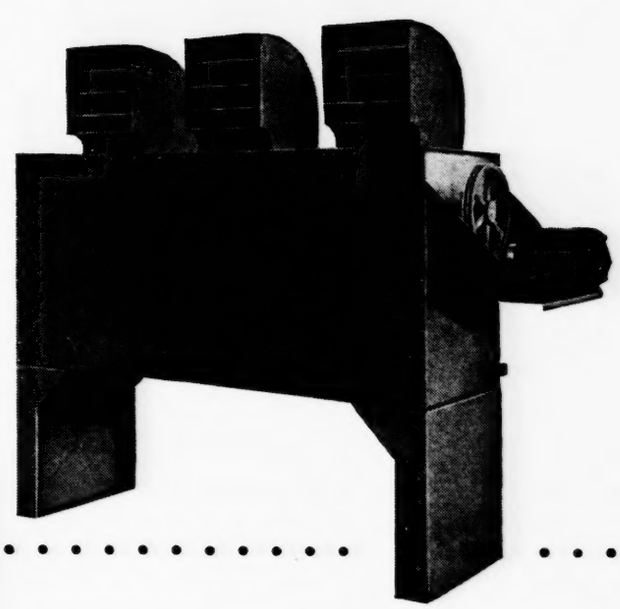
HEAT LARGE FLOOR AREAS EFFICIENTLY, ECONOMICALLY WITH AIRTHERM BLOWER FAN TYPE UNIT HEATER



The Airtherm Blower Fan Unit Heater is a quiet operating, high-velocity unit of rigid construction for installation in all types of industrial buildings with large floor areas. The high velocity outlet nozzles spread heat evenly over wide areas.

Install Airtherm Blower Type Unit Heaters in your plant and cut heating costs through efficient heat distribution. Floor-mounted or suspended models.

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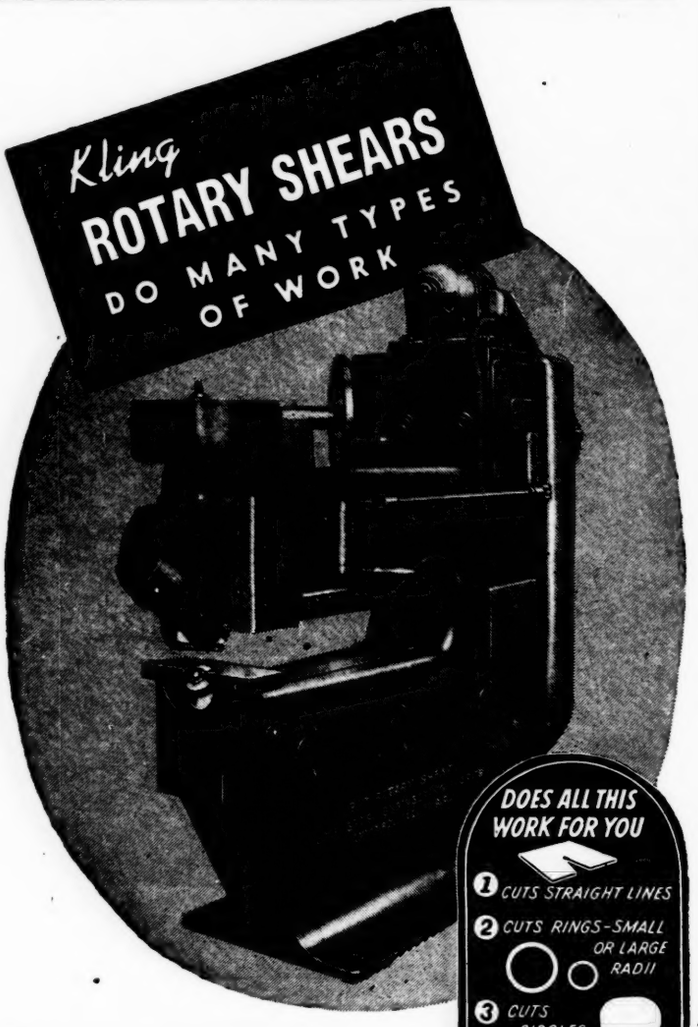
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DO MANY TYPES OF WORK
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3 CUTS CIRCLES
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5 CUTS INSIDE HOLES WITHOUT CUTTING IN FROM EDGES
6 JOGGLES & OFFSETS
7 CUTS ODD SHAPES
8 BEVELS OF ANY ANGLE
9 CUTS REVERSE CURVES
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ALL WITH Hairline PRECISION

Yes, and With Hairline Precision

Rapid operation . . . Hairline Accuracy . . . the use of Kling Rotary Shears marks the latest development in cutting mild steel, and sheet metal, up to 1-inch with amazing savings in time, labor, and production costs.

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which will give you specific facts, and specifications. No obligation involved. Users of heavy equipment of Kling Rotary Shears' class will receive a copy of this Bulletin promptly, on request.

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ABSTRACTS AND REVIEWS

ALUMINUM DATA BOOK

Detailed information on Reynolds aluminum alloys and aluminum mill products is presented in a company handbook. The information includes alloy tempers; physical properties; chemical, physical and mechanical properties of high purity aluminum; nominal chemical compositions; typical mechanical properties; coefficients of expansion; thermal and electrical conductivity; annealing and heat treating cycles.

Sections of the book are devoted to sheet and plate, extruded shapes; roll formed shapes; tubing and pipe; wire, rod and bar; forging stock; ingot metal; press forgings. In addition there is information on various wrought aluminum alloys in sheet form and forging alloys.

Reynolds Data Book. Heavy paper cover, spiral bound, 5¾ x 8¾ in., 245 pages. Published by Reynolds Metals Co. Price, $2.

OIL FOR VICTORY

During the war years, the heating industry felt the limitations of fuel oil control, and gasoline for transportation needs.

The problems that existed in delivering petroleum to the armed forces, the other side of the picture, is interestingly told by the Editors of *Look* in a book that is profusely illustrated with photographs. It relates the story of how this country, fighting against time and powerful foes, succeeded in delivering petroleum at points where it was most needed.

As oil was considered to be a $15-billion industry in times of peace, its importance as a factor in war and peace is not difficult to demonstrate.

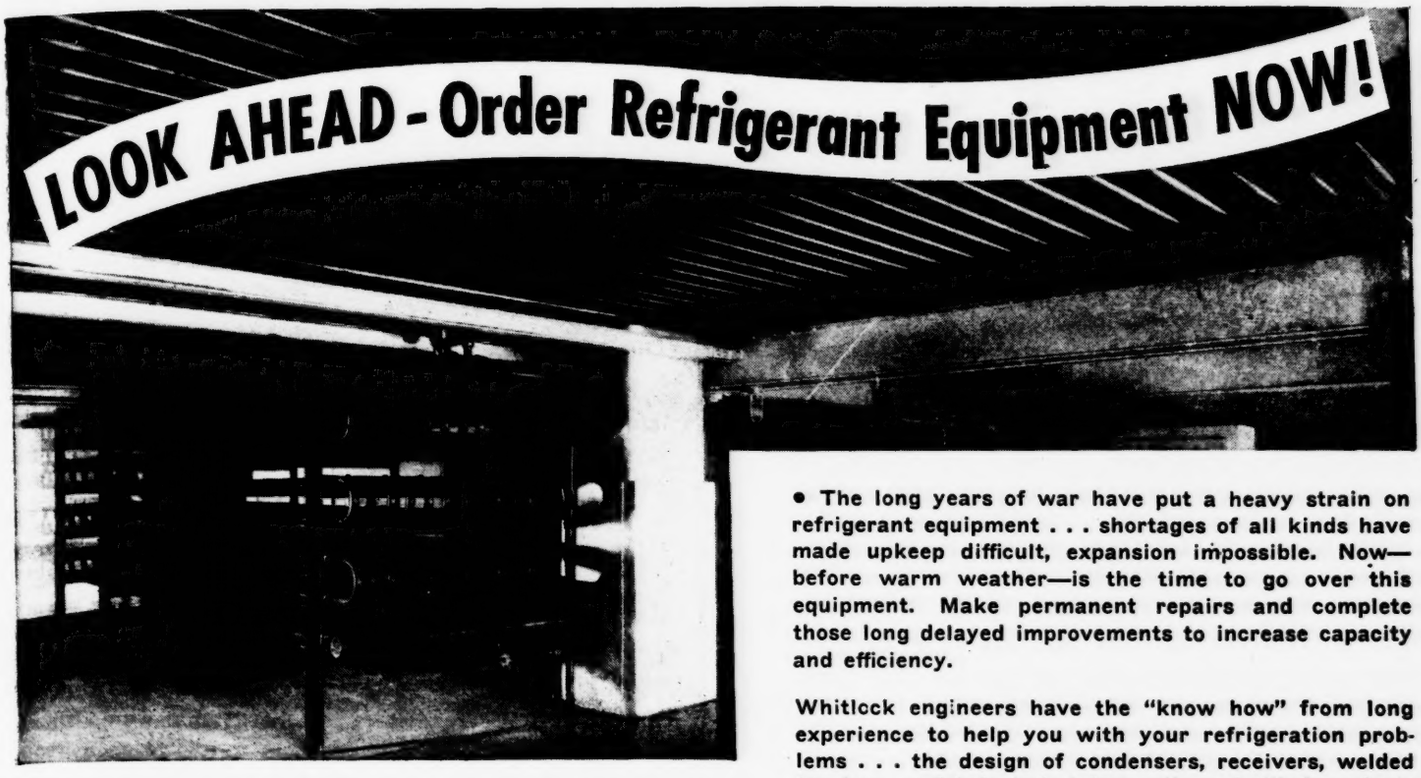
Here is a story that is interestingly told and very well illustrated.

Oil for Victory, by the editors of LOOK magazine. Cloth bound, 6½ x 9½ in., 287 pages. Published by McGraw-Hill Book Co. Price, $3.50.

● ● ●

TESTING HAND FIRED BOILERS — A recommended standard for Testing and Rating Hand Fired Hot Water Supply Boilers, TS-4281, has been issued by the National Bureau of Standards as proposed by The Institute of Boiler and Radiator Manufacturers. All sizes of hot water supply boilers are covered. Advices from the trade, as reported, indicate that the adoption of these standards is generally acceptable. For a copy write to the U. S. Department of Commerce, Washington 25, D. C.

SMOKE—ITS CAUSE AND PREVENTION—A discussion of smoke abatement is contained in a 14-page booklet edited by M. W. Crew, manager of the Industrial Controls Division of the Perfex Corp. It has data on the cause of smoke and the proper burning of fuel. For copies, write Perfex Corp., 500 W. Oklahoma Ave., Milwaukee 7, Wis.



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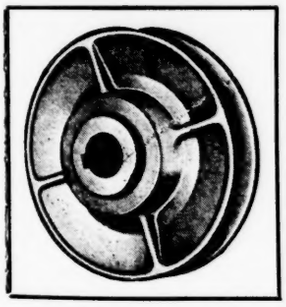

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Ideal for Fans, Blowers, Stokers, Pumps, Oil Burners, Air Conditioners, Refrigerators, Compressors, etc. Made of Virgin Zinc Alloy. Accurate, perfect balance. Speed variations of approximately 30% may be obtained by using variable Pitch Pulley in drive—variations of about 500% by using both pulleys of this type and by interchanging them on motor and driven shafts. Grooves accurately built to belt, with perfect grip, silent and true running. For following V-Belts: 0—3/8", A—1/2" and B—5/8". Dimensions: Bore diameters, 1/2" to 1". Width of belt groove, min. 1/2", max. 7/8". Overall length of pulley, 1 5/8".

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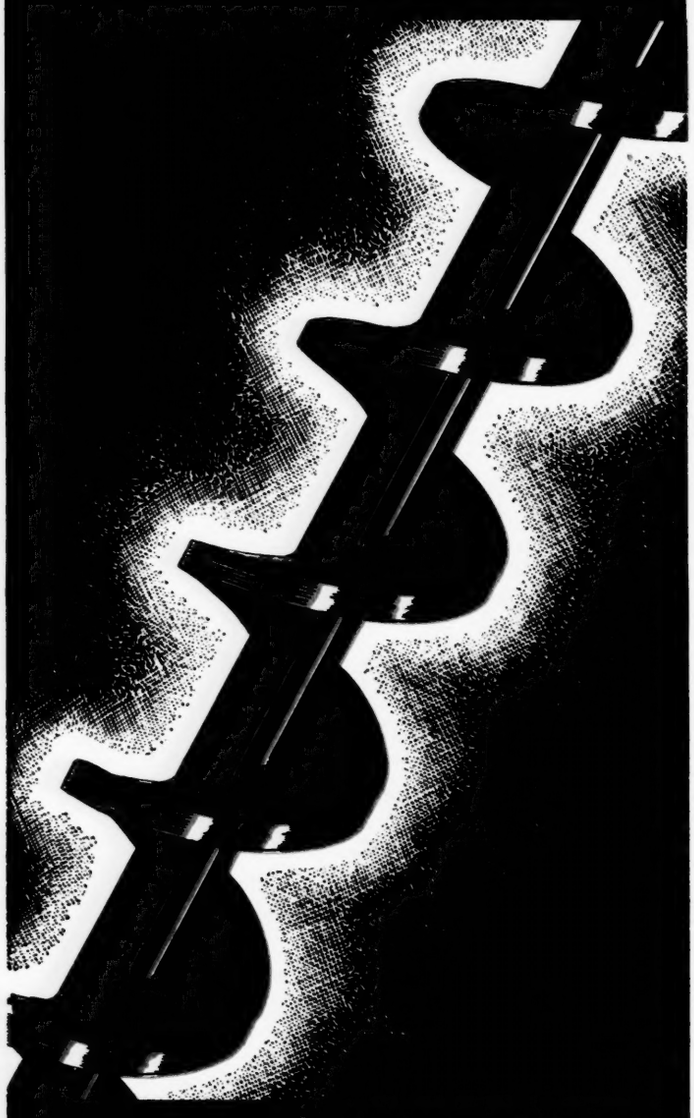

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NEW CATALOGS

Flame-Cut Shapes

A new illustrated bulletin on flame cutting describes Ryerson facilities for producing plain and intricate shapes from steel plates. Sample cuttings are shown and uses described.—*Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill.* **191**

Dust Collectors

Bulletin No. 101, 16 pages, describes Hydro Whirl dust collectors with industrial installation photographs, layout drawings, selection charts and engineering data. First in a series of bulletins which will make up a general catalog.—*Peters-Dalton, Inc., 17908 Ryan Rd., Detroit 12, Mich.* **192**

Gas Load Building

"The Arm-In-Arm Plan for Profitable Load Building" in a revised edition presents a plan for gas company-wholesaler-dealer cooperation. Purpose of the plan is to lay before the gas industry the advantages of dealer utility and wholesaler cooperation in sales planning and gas load building.—*Bastian-Morley Co., Inc., La Porte, Ind.* **193**

Electric Motors

The complete line of Emerson Electric capacitor-start motors is pictured and described in a new four-page bulletin showing details of construction, dimensions and diagrams and rating standards for fractional horsepower motors.—*The Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis 3, Mo.* **194**

Carbide Tipped Masonry Drills

Attached 4-page color bulletin gives description, specifications and prices on new type Metro standard carbide tipped masonry drills that are said to last up to 50 times longer than ordinary steel drills and speed up drilling work 75%.—*Metro Tool & Gage Co., 4240 W. Peterson Ave., Chicago 30, Ill.* **195**

Close Coupled Centrifugal Pumps

An 8-page pamphlet, Bulletin 300-A, covers Quimby close-coupled centrifugal pumps. Designated as Model "Q", the pump is designed for general service with capacities from 10 to 1000 gpm.—*H. K. Porter Co., Inc., 1932 Oliver Bldg., Pittsburgh 22, Pa.* **196**

Home Precipitator

An electronic precipitator for cleaning air in residential air conditioning or warm air heating systems is described in a 4-page folder, DL-P-509.—*Raytheon Mfg. Co., Waltham 45, Mass.* **197**

Residential Steel Boilers

A 4-page folder describes tubeless residential steel heating boilers for all types of fuel in sizes rated from 400 to 1800 sq ft of steam.—*Republic Boiler Corp., 30 Church St., New York 7, N. Y.* **198**

BEND COLD PIPE QUICKLY, EASILY

● Speed piping installations this efficient, easy, economical way . . . make "on the job" bends in pipe up to 4½" with a GREENLEE Hydraulic Bender.

With a GREENLEE *one man* makes smooth, accurate, uniform bends in a few minutes. You save greatly through elimination of manufactured bends, many fittings, and the work of threading them. And, in timesavings alone, the GREENLEE pays for itself quickly.

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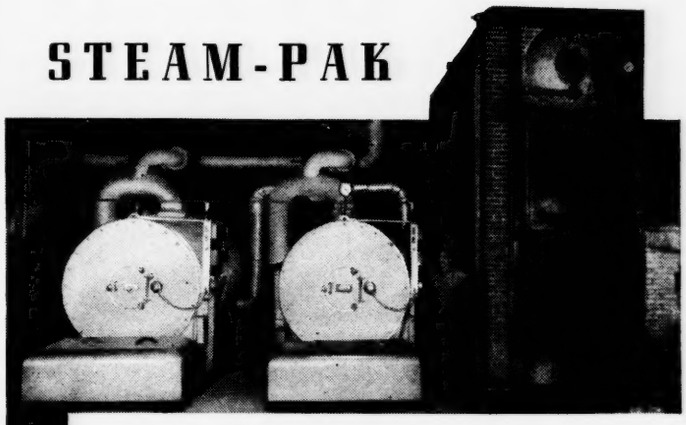

GENERATORS GO TO COLLEGE

At Woodstock College in Woodstock, Md., *two* SPL-100 (100 h.p. low pressure) *Steam-Pak Generators* have replaced *three* 80 h.p. boilers. It doesn't take a mathematics professor to figure out that a 200 h.p. system is now doing the work formerly done by a 240 h.p. job . . . to say nothing of the economy and convenience of *fully automatic* oil heat.

STEAM-PAK YORK HEAT GENERATOR

Steam-Pak Generators are built right, installed right, and serviced right by a factory-distributor-dealer organization that knows how. Complete lines of low pressure (heating) and high pressure (process steam) units range from 15 to 100 h.p. for No. 3, 5, or 6 oil. The 30, 50, 75, and 100 h.p. low pressure units are available for *immediate* installation. Industrial Division, York-Shipley, Inc., York, Pa.

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Oil-Fired Equipment for Industry

America's Most Complete Line

Request catalogs: ID-47-8B tells the sales story; ID-46-1B gives "facts and figures" about *Steam-Pak Generators.*

For Local Dealer: Call FOrdham 7-2069

CLOSE SELECTIVITY THROUGH APPROXIMATELY 100 SIZES

Units range from 18.4 to 1421 square feet of cooling surface . . . and capacities range from 2 to 150 tons.

With 100 different sizes within the above limits, the buyer of a Patterson-Kelley Cooler for Freon, or Methyl Chloride, can so closely match his requirements including a suitable safety factor that he need not buy excess, unusable capacity.

Such broad service to the air conditioning and refrigeration industries implies **specialization**. And that is just what Patterson-Kelley Engineers have been doing for many years . . . specializing in Coolers, Condensers, Liquid Line Heat Exchangers and other heat-transfer equipment needed in your industry.

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Strip Chart Potentiometers

The ElectroniK strip chart potentiometer is described and illustrated in catalog 15-10. Electronic "continuous balance" operating principles are featured, as well as constructional details. Also included are illustrated descriptions of the various types of Brown ElectroniK potentiometers, standard speed, fast speed and high speed; Con-Tac-Tor auxiliary switch forms; the ElectroniK potentiometer controller; precision indicator and thermocouple assemblies, chart and list of strip chart and scale ranges.—*The Brown Instrument Co., Wayne & Roberts Ave., Philadelphia 44, Pa.* **199**

Spray Booths

Bulletin No. 201, 16 pages, covers Hydro Whirl spray booths with photographs, specifications, sizing, data, etc.—*Peters-Dalton, Inc., 17908 Ryan Rd., Detroit 12, Mich.* **200**

Rubber Lined Pipe

A catalog section describes standard pipes and fittings lined with rubber by the Vulcalock process as protection against corrosive or abrasive action of materials. Standard wrought steel, wrought iron, cast iron and Armco spiral welded pipe are lined with several types of rubber by the Vulcalock process to meet specific service requirements. The catalog section describes each of these linings and its functions.—*The B. F. Goodrich Co., Akron, Ohio.* **201**

Diaphragm Control Valves

Bulletin 500, 24-pages in 2 colors, presents the series 700 line of Belfield diaphragm control valves. Engineering and performance data, cutaway drawings, and photographs are shown with details of construction, dimension tables, and shipping weights.—*H. Belfield Company, 435 N. Broad Street, Philadelphia 23, Pa.* **202**

FEBRUARY, 1947

TO OBTAIN COPIES OF TRADE LITERATURE listed in this issue, circle on the list below the publications wanted, using the item number at the end of each review.

Print your name and address, mail to
Editor, HEATING AND VENTILATING,
148 Lafayette Street, New York 13, N. Y.

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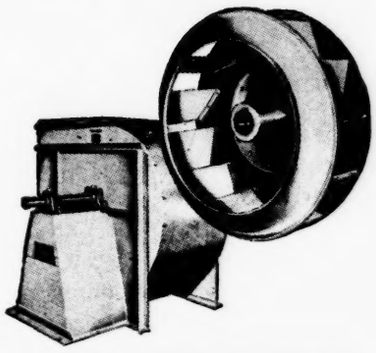

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LARGE, LIGHTWEIGHT AND EXTREMELY FLEXIBLE HOSE—*the easy way to ventilate confined spaces, control fumes and dust.*

1¼" TO 24" DIAM.

3 TYPES—TO MEET EVERY PURPOSE

Many constructions and accessories available—all made with weather and fume resistant Neoprene.

- **FLEXAUST** (as illustrated) —Spiral wire reinforcement
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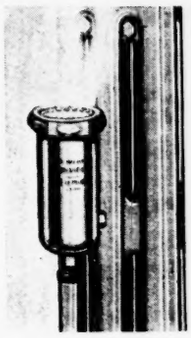
don't let LACK OF HUMIDITY spoil your heating jobs!



No. 95 AUTO-VENT installed on steam radiator in place of the usual air valve.

Use AUTO-VENT AUTOMATIC HUMIDIFIER

on low pressure steam systems

"IT VENTS AS IT HUMIDIFIES"

Discharges one pint of water vapor per hour at one pound steam pressure—sufficient humidity for 2,000 cu. ft. of space. Easily regulated — noiseless in operation. To install, merely remove air valve and screw in AUTO-VENT.

Made entirely from non-ferrous metals to last indefinitely. Nationally advertised product—thousands now in use giving perfect satisfaction.

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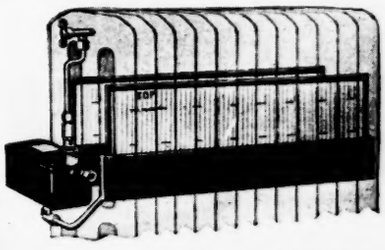
Ol' Faithful AUTOMATIC HUMIDIFIER



No. 34 OL' FAITHFUL Humidifier installed on hot water radiator.

Equipped with patented copper bound, corrugated evaporators which vaporize as much as 1½ gal. of water daily at hot water radiator temperature of 130°—capacities 20% greater on steam radiators. Constant water line automatically maintained. Easily installed.

Supply water can be taken directly from hot water radiator, or on steam radiator from nearest water line. Made in three sizes: 18", 24" and 36" lengths. Furnished complete as shown.

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Use Our CONVECTOR Automatic Humidifier

for all types of Warm Air Furnaces and Winter Air Conditioning Systems . . . MAID-O'-MIST also manufactures Water Line Control Valves and other Heating Specialties.

WRITE TODAY for complete engineering data and prices on entire MAID-O'-MIST line . . . Learn NOW about our many exclusive sales features!

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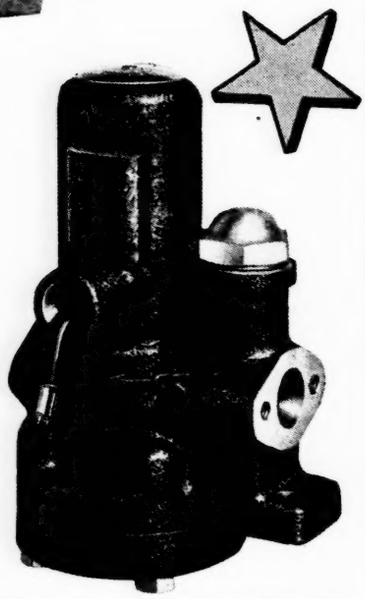
AUTOMATIC HUMIDIFIERS FOR ALL TYPES OF HEATING SYSTEMS

YOUR BEST AIR CONDITIONING EQUIPMENT DESERVES THE DEPENDABILITY OF A-P REFRIGERANT VALVES

A-P Dependable Refrigerant Valves help you maintain peak operating efficiency at all times — the pride and proof of fine air conditioning, and the engineering skill involved in its installation. Prove this to your own benefit on new or present systems.

DEPENDABLE
MODEL 220-K
THERMOSTATIC
EXPANSION VALVE

Supersensitive, accurate provides closer superheat control over a wide range of operating temperatures. Capacity, up to 16 tons Freon.



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REFRIGERANT
VALVE

Compact, rugged, leakproof, quiet and positive in operation. Flange sizes for wide variety of applications. Opens quickly and easily on minimum power, even at high pressures. Capacity, up to 20 tons Freon.

Other A-P DEPENDABLE Refrigerant Valves include: Water Solenoids, Suction Pressure Regulating Valves, Water Regulating Valves, "Trap-Dri" Drier-Filter-Strainer, "Trap-It" Filter-Strainer, and Thermostats.

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DEPENDABLE *Refrigerant Valves*
FOR AIR CONDITIONING • REFRIGERATION • HEATING

WHAT READERS SAY

Radiant vs. Convection Heating

EDITOR, HEATING AND VENTILATING:

I was very much interested in Mr. Dixon's article, "Will Radiant Heating Displace Convection Heating?" in December issue of HEATING AND VENTILATING, and I am very glad that you have so excellently presented these phases in the development of panel heating.

In the relation of panel heating to residences either small or large, I have always felt that the use of this system for the bed rooms would be unsatisfactory because of the lack of flexibility in securing a cool period while the occupants are asleep, and the long warming up period in the morning.

There would probably be no objections to a split system, panel heating for living rooms requiring a constant 24 hour heat input, and convectors in bed rooms requiring quick night cooling and morning warming up.

Herbert A. Snow,
Buerkel & Company Inc.
Boston, Mass.

EDITOR, HEATING AND VENTILATING:

We found Mr. A. G. Dixon's able defense of convection heating not only thought provoking, but also a direct challenge to the advocates of panel heating to rise to the defense of its virtues.

Mr. Dixon, as a proponent of convected heating, concedes any comparison of it with panel heating involves factors too numerous to mention in a short article. One of these unmentioned factors is the present trend among architects toward homes complete on one floor, with little or no basement. This trend is not a result of panel heating, because it preceded it. Heating such a home with convected heat always produced a cold floor problem, but the trend continued because the architects felt that such a home offered balancing advantages, such as convenient living, ease of construction, maintenance, etc. Panel heating, when it appeared, went into this type of house as naturally as the proverbial duck goes into water. What Mr. Dixon regards as architectural and structural favors necessary to accommodate panel heating can not, in my opinion, be regarded as favors at all, for such homes are generally built in the same manner when they employ convected heat, as many do. The fact that many owners of modern basement-less homes with concrete slabs still prefer to use convected heat is not so surprising, when one considers the fact that engineers who are capable of designing a panel heating system are by no means common to every community. Also, the general public is still skeptical. It is perhaps significant that the greatest proportion of panel heating installations appear in the West; while the East, well-known for conservatism, prefers convected heat.

Mr. Dixon's statement that heavy wall insulation is desirable, and will raise the mean radiant temperature of a room, is hardly one to disagree with. However, our aforementioned modern house has usually a large glass area which will materially reduce the MRT of the room. Panel heating will overcome this; if con-

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1—Because they know they get more for their money.
2—Insulation is always dry.
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ALL-PURPOSE FANS For Better Ventilation

The office, home, factory, restaurant, garage, warehouse, class room or a hundred other places where proper ventilation is the prime requisite for health and comfort, makes the new 1947 Johnson HEALTHAIRE fan a MUST!

BELT DRIVEN TYPE
Sizes: 24" to 48"

Johnson HEALTHAIRE fans are available in two types ... Belt Driven (ranging in size from 24 inches to 48 inches) and Direct Driven (from 12 inches to 20 inches).

DIRECT DRIVEN TYPE
Sizes: 12" to 20"

Beauty, style and ruggedness has been incorporated into the 1947 HEALTHAIRE line, making a more modern and longer lasting fan of proven quality.

Johnson Fan & Blower Corp.

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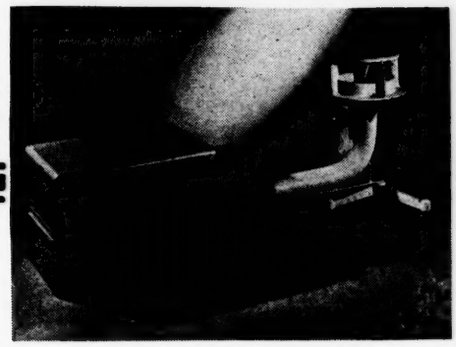

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EASY TO INSTALL— Gas inlet headers permit the gas supply to be connected on either side of the burner. Pilot connection is reversible. Leveling of the burner unit inside the firebox requires only a few minutes. The total assembly and installation is accomplished quickly, without cooling the house.

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COMPACT—SAFE—CLEAN! The Gregory unit occupies the least practical space outside the heater, and controls and connections are all enclosed in a steel housing of hammered-bronze, baked enamel finish, harmonizing with any finish on heater and surroundings, and proof against scratching or marring.

PROFITABLE TO SELL AND USE. Scientific design based on broadest experience in gas combustion engineering, and precision manufacture in quantity, gives a unit that can be sold to the broadest market and at a good profit.

DISTRIBUTORS—WRITE! Get in line for the coming season! Gas is the coming fuel, the Gregory Burner will enable you and your customers to take full advantage of its great convenience, comfort and genuine economy. Distributorships in certain areas are open—Let us hear from you! Write today.

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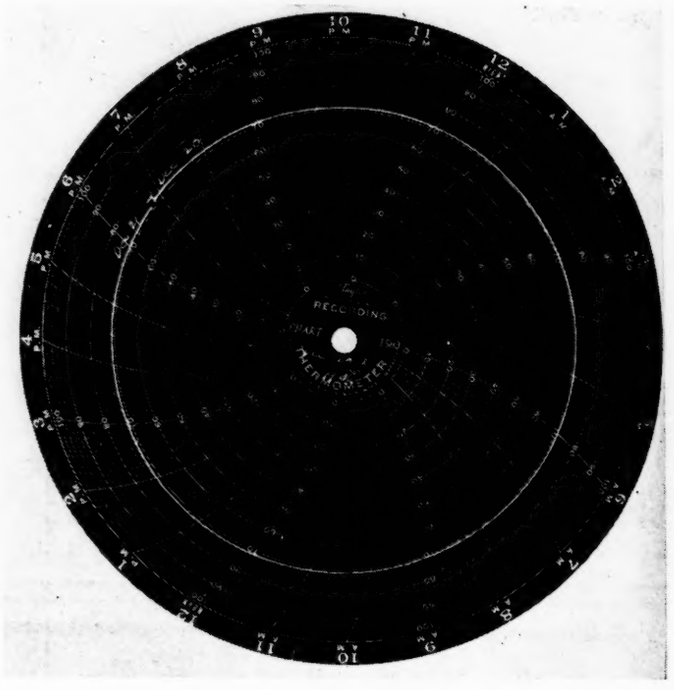
vected heat is used in such a house air temperature as high as 80F may be found necessary for comfort.

As for costs: In Mr. Dixon's words, let us take this one apart. His article states that the elaborate controls necessary for a panel system should also be considered part of a convected system before performance is compared. That is entirely true, but on that basis I am sure that convected heat will lose any price advantage which may exist today. And when radiant heating units enjoy the mass production which convectors have, they should be much cheaper.



After so much has been published in various magazines about the virtues of panel heating, it seems superfluous to repeat them again. Nevertheless, any comparison of heating systems must consider these advantages if it is to be cool and impartial. Features such as absence of radiators in a room cannot merely be shrugged off as "absence of five o'clock shadow." Convection heating cannot produce the uniformity of air temperature in either horizontal or vertical planes which is characteristic of panel heating. A perfect heating medium should be neither seen nor felt, and panel heating achieves this perfection to an extraordinary degree. While I agree that relative merits should be considered with equivalent controls, the necessity for elaborate controls on panel systems has yet to be proven. Our own home has a typical floor panel heating system, with wrought iron pipes laid at the bottom of a 4 in. concrete slab. Although this slab weighs about thirty tons, the entire system, using continuous circulation, is operated by a simple snap action room thermostat. All cycling in the water temperature is absorbed by the concrete slab, and the evenness of the resulting air temperature leaves nothing to be desired.

As for time lag heavy wall insulation, as recommended by Mr. Dixon, will reduce indoor temperature fluctuation to the point where a panel system can cope with it easily; we have experienced no trouble with overshooting or undershooting. The air temperature

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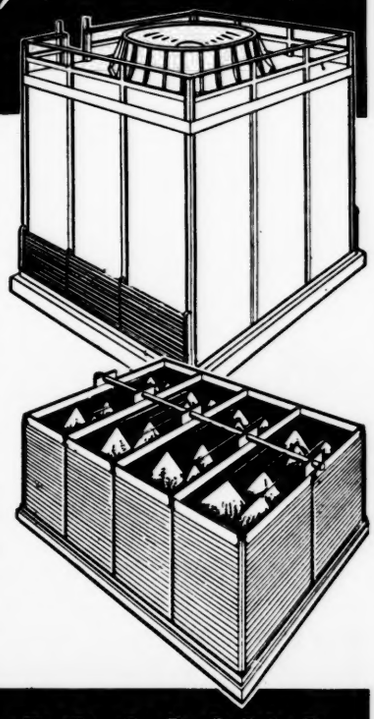

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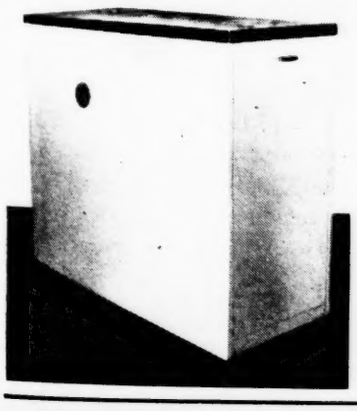

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chart accompanying this article shows results on a typical December day. This chart was made on a recording thermometer placed in the living room near the thermostat, but equally uniform results are obtained in the other rooms.

However, the bone of contention in Mr. Dixon's article was whether or not radiant heating would displace convected heating. He says it will not, and once again I agree with him. Convected heat will certainly be favored in installations which involve remodelling of existing homes. And people building new homes, especially with full basements, will find that there is merit in the old as well as the new.

Walter A. Batjer

Rochester, N. Y.

EDITOR, HEATING AND VENTILATING:

The December issue of HEATING AND VENTILATING is in my opinion one of the most interesting you have ever issued. I sat down on the Saturday on which it arrived and read it from cover to cover.

The article by A. G. Dixon entitled, "Will Radiant Heating Displace Convection Heating" is exceedingly well written and timely. It is high time that this subject is carefully scrutinized by heating and ventilating engineers.

Let me first state my position by assuring you that I am not on the selling side of heating, being the mechanical engineer of research at the Mathieson Alkali Works, Inc. We sell only heavy chemicals, such as Chlorine and caustic. I am very much interested, however, in the best method of heating, both industrial buildings and homes.

Also, let me hasten to assure you that I agree with about 80% of your statements, but would like to point out some slight differences that are quite generally accepted by the industry.

To test this question further I have prepared a set of formulas from data in the 1946 issue of the ASHVE *Guide* and other accepted sources. These formulas follow:

The body heat loss by convection can be expressed as

$$C = 1408 - 17.6A \qquad (1)$$

where C is the loss by convection in Btu per hour and A is the mean air temperature F.

The heat loss from the body by radiation is not quite a straight line formula, but a line graph is fairly accurate in the most-used range from 65 to 75F and can be expressed as

$$R = 1124 - 14M \qquad (2)$$

where R is the body's radiation to walls in Btu per hour, and M is the mean radiant temperature of the walls, F.

At a constant radiation loss plus convection loss of 310 Btu per hour, based on a total loss for comfort of 400 Btu per hour, less the evaporation loss of 90 Btu per hour, the required mean air temperature would be

$$A = 128.4 - .825R \qquad (3)$$

where A is the mean inside air temperature, F, and R is the MRT of walls, F.

Next we find the difference we can expect between inside air temperatures and the surface temperature on the room side of the exterior walls for various overall heat transfer factors. We need to use the difference here because every time we change the air temperature we also change the MRT.

This temperature difference can be expressed as

$$T_d = \frac{U}{f} (T_a - T_o) \qquad (4)$$

where T_d is the depression of the inside wall temperature below the inside air temperature, F; U is the heat transmission coefficient in Btu per hour per square foot per degree temperature difference; f is the inside film coefficient usually taken at 1.65, T_a is the air temperature in the room, F; and T_o is the outside air temperature, F.

By determining the differences in MRT above or below the air temperature that would satisfy the comfort loss of 310 Btu per hour, we have

$$T_a = 70.33 + .4533T_d \qquad (5)$$

where T_a is the required air temperature, F, and T_d is the depression of the inside wall temperature below the inside air temperature.

By combining equations (4) and (5) we have

$$T_a = 70.33 + .4533 \frac{U}{f} (T_a - T_o)$$

Simplifying and substituting the value 1.65 for f, we have

$$T_a = \frac{70.33 - .275\ UT_o}{1 - .275U} \qquad (6)$$

Referring to formula (6), we find that in zero weather an average living room with a wall coefficient of .065 (which happens to be the coefficient of my own well-insulated house), an air temperature of 71.5F would be found as desirable for comfort in this room. The formula, however, is optimistic, for we prefer 73F.

Similarly, referring to formula (6), we find that for the average fairly well-insulated house with a U factor of .20, we would require an air temperature of 74.5F in zero weather for comfort. For an average uninsulated house with a U factor of 0.30, we would require in zero weather an air temperature of about 76.7F for comfort. On the other hand, referring to formula (5), we find that we would be comfortable with an air temperature of only 64F with the MRT of the walls raised to 64 + 14 = 78F [note that in formula (5) the last part of the formula becomes negative if the temperature of the wall is higher than the temperature of the air].

The foregoing shows that even with insulated walls, it is necessary to maintain a higher air temperature to maintain comfort in cold weather with convection heating than with radiant heating where some of the enclosing surfaces are warm.

Now, to summarize, radiant heating with pipes in the floors and walls, circulating warm water, is admittedly rather difficult to install and is slow to respond to temperature changes. However, in designing a research laboratory with fume hoods in each laboratory providing at least 10 changes of air per

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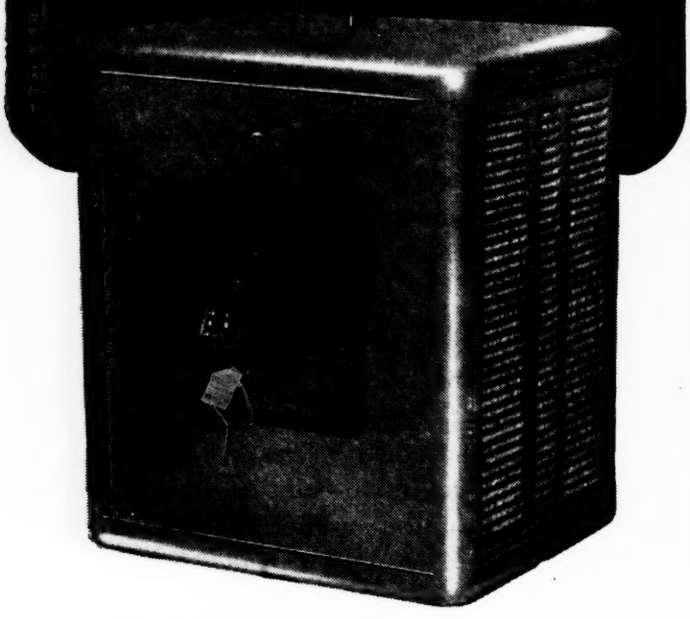

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hour, I would choose a radiant heated floor with some additional cast iron radiators. In plant heating, unless unit heaters are carefully engineered and carefully located, we have strenuous objections from the workmen on alternate hot blasts of air and cold off periods.

For home heating, the day is definitely gone when we can claim comfort conditions by merely boosting the air temperature. The Romans were very close to the ideal systems. We shall soon see homes heated by circulating warm air through the walls, floors and ceilings. When building conditions permit, I hope to build such a house and have it already designed.

The symposium on the heat pump is of equal interest. Isn't it surprising how slowly this idea has progressed since it was first proposed by Lord Kelvin so many years ago?

In comparing the relative costs of heat pump heating with conventional types, would it not be more equitable to take the efficiency of gas at 80%, oil at 75%, and hand fired coal at 50%? I refer to Fig. 7, page 71.

Another engineer, C. H. Richardson, and I at one time made up a complete heat balance for absorbing the heat from the sun by circulating water through a radiator arranged to receive all the heat that was radiated from the sun to an average house roof. The water was dropped immediately to an insulated reservoir below the basement floor. If all our calculations were correct, a house could be heated by this means even in Niagara Falls. The thought that occurs to me is that using such a reservoir as the heat source for the heat pump would provide an ideally economic system, as the water temperature was never less than 70F in the reservoir.

Elbert H. Coe,
Mechanical Engineer,
Mathieson Alkali Works, Inc.
Niagara Falls, N. Y.

EDITOR, HEATING AND VENTILATING:

I have read the article "Will Radiant Heating Displace Convection Heating", by A. G. Dixon, in HEATING AND VENTILATING. I have read this article with great interest and have passed it all around our organization; I think it is one of the best statements on the subject that I have seen. As with many subjects some people seem to have gone off the deep end on radiant heating and the sober and balanced discussion above referred to is certainly healthy. We use convection heating extensively in the heating of operators rooms in water and sewage disposal plants. There may be some opportunities for the use of radiant heating and we are giving consideration to it under certain situations, but as yet have made no actual installation.

R. L. McNamee,
Shoecraft, Drury and McNamee
Consulting Engineers
Ann Arbor, Michigan

Heat Pump Coefficient of Performance

EDITOR, HEATING AND VENTILATING:

In your December, 1946, issue there is a reference section entitled "Progress Report on the Heat Pump."

In my opinion this is a splendid piece of work and gives a clear picture of the present status of the heat pump. However, there is a mis-statement in the third paragraph of the first paper, which I believe should be corrected. I say this because I feel that we should make every effort to clarify the thinking that is being done at this time on the subject of the heat pump.

The statement to which I have reference, is:

"If Q_1 is the refrigerating effect of a refrigerating system and Q_2 the energy input to the compressor motor to produce this effect, then the heat obtained from the heat pump is $Q_1 + Q_2$ and the ratio of total heat obtained to heat paid for is

$$\frac{Q_1 + Q_2}{Q_2}$$

This ratio is called the coefficient of performance. . . ."

It seems to me that the coefficient of performance of a heat pump which is being used for heating purposes, is the ratio of the heat rejected in the condenser to the thermal equivalent of the energy input to the system. Specifically, if we speak of the coefficient of performance of the compressor system proper, disregarding energy input to auxiliaries, the coefficient of performance may be said to be the heat rejected in the condenser divided by the energy input to the compressor motor. Now if Q_2 represents the energy input to the compressor motor, obviously the condenser does not reject Q_2. It does not even reject all of the thermal equivalent of the energy delivered to the compressor shaft. The overall efficiency of the compressor must be taken into account, as well as the efficiency of the motor. Thus, besides the refrigerating effect, Q_1, the condenser only rejects some 70% of Q_2. If the quoted equation be employed, for a refrigerating system operating between 112F condensing temperature and 0F suction temperature, the resulting coefficient of performance would be approximately 12% too high. Therefore, it seems to me that the statement and formula as given, are misleading and confusing. . . .

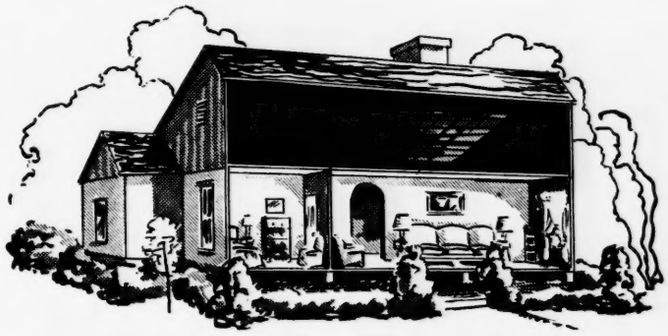
Wm. Parkerson
Rate Engineer
Middle West Service Co.,
Chicago, Ill.

EDITOR, HEATING AND VENTILATING:

I wish to thank Mr. Parkerson for pointing out that the coefficient of performance in the "Progress Report on the Heat Pump" in HEATING AND VENTILATING, December, 1946, is somewhat misleading and confusing. The equation referred to represents the maximum coefficient of performance which can be obtained for a condensing unit when all the energy input to the compressor motor can be considered useful heat. This should be the aim of all designs, but I agree with Mr. Parkerson that it is not always possible or practical to do so. However, since in many cases all the input to the compressor motor can be considered useful heat, the coefficient of performance is not always the ratio of the heat rejected by the condenser to the thermal equivalent of the energy input to the system, as stated by Mr. Parkerson.

Actually the coefficient of performance, during the heating cycle, is the total heat output divided by the heat equivalent of the work input. The equation

EVER SEE



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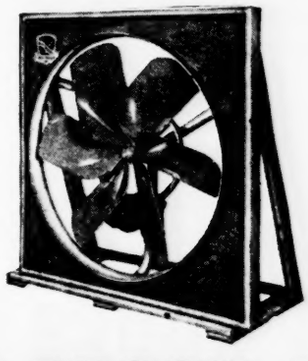

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$\frac{Q_1 + Q_2}{Q_2}$ would be applicable to all cases by introducing a factor K to represent the amount of energy input which could be considered useful heat. The revised equation would then be:

$$\text{Coefficient of performance} = \frac{Q_1 + KQ_2}{Q_2}$$

where Q_1 = refrigerating effect,

Q_2 = energy input to compressor motor or to compressor motor and all auxiliaries, depending on whether the condensing unit only or the entire system is being considered, and

K = multiplying factor to give the amount of total energy input which can be considered useful heat. If all of the energy input is useful heat, then $K = 1$

E. R. Ambrose,
Air Conditioning Engineer
American Gas and Electric Service Corp., New York, N. Y.

Getting Personal

Frank Tyler

Frank Tyler *(High Pressure Steam with Unit Heaters*, page 75) was born near DuQuoin, Illinois, where he obtained his first experience in the heating field. After high school and a few months of business college, the next few years were spent as fitter's helper, pipe fitter, and subsequently superintendent for the local gas company.

Mr. Tyler put in five years as "Swamp East" Missouri traveling representative for Crane Company, and in 1919, he came to Moline to associate himself with The Herman Nelson Corporation where he could devote all his efforts to the heating and ventilating business. He has since that time served Herman Nelson in practically all phases of the sales engineering field. He has served under the various titles of sales representative, assistant sales manager, chief sales engineer and chief application engineer. His present duties include educational work in the field and extension work with product application engineers, trainees, and distributor organization. His hobbies are golf and, mildly, bowling.

R. S. Dill

Richard S. Dill *(Temperature Distribution in an Experimental Low-Cost House*, page 67), was born at New Bern, North Carolina, on March 23, 1901. He graduated from the New Bern High School and from the North Carolina State College of agriculture and engineering in 1923 with a B.S. degree in mechanical engineering. He had various engineering experience subsequent to graduation, including 18 months in the engine estimating department of the Newport News Shipbuilding and Drydock Company, a year in the building

construction field, and two years operating a mill and a brick yard as a member of partnership.

In October of 1928, he entered the Automotive Section of the National Bureau of Standards where he conducted tests of Automotive engines, fuels, lubricants and accessories until 1933. He then was transferred to the Heat Transfer Section where he has since conducted and supervised research and testing on heating, air conditioning and refrigerating equipment, insulating materials, air cleaning devices, water heaters and other appliances. He became chief of the Heat Transfer Section January 1, 1940.

He lectured on refrigeration and air conditioning at the University of Maryland for four years and is the author of numerous papers on heat transfer and building problems. He is a member of the American Building Congress, ASHVE, and ASME.

P. R. Achenbach

Paul Reece Achenbach (*Temperature Distribution in an Experimental Low-Cost House*, page 67) was born December 13, 1911 at Thelma, Alberta, Canada. At the age of 9 he moved to the United States, living in Sheridan, Wyoming until completion of high school in 1924. He received his B.S. degree in electrical engineering in 1931 and a B.S. degree in mechanical engineering in 1932 from the University of Wyoming at Laramie. He was elected to honorary societies Phi Kappa Phi and Sigma Tau during his college career.

After a year and a half at the Western Public Service Co. plant in Laramie, Wyoming, operating a pulverized-coal-burning power plant, he joined the U. S. Engineers and assisted with the building of Fort Peck Dam, largest earth fill dam in the world, on the Missouri River in Montana. He resigned at the Fort Peck project in 1937 to accept a position at the National Bureau of Standards in Washington, D. C. conducting research and tests on domestic heating, air conditioning, and refrigerating devices.

He has been in charge of the research on temperature distribution in a full-scale four room bungalow since it was first built on the grounds of the Bureau in 1940.

He was in charge of research, testing, and development work on mobile refrigerators and refrigerating equipment conducted at the Bureau of Standards during the war for the Office of the Quartermaster General. This work is being continued at the present time to improve existing equipment. He is a member of ASHVE and ASRE.

John "Doc" Cassie, (*Give Your Fan a Chance*, page 72) a specialist in mechanical draft, ventilating, and other air-handling equipment, has been associated with the B. F. Sturtevant Co. since 1927. This company is now a division of the Westinghouse Electric Corp.

After receiving the degree of Mechanical Engineer from Stevens Institute of Technology in 1925, Mr. Cassie joined the 3-month student course of the Bethlehem Steel Co. in Bethlehem, Pa., and continued with that company until he joined Sturtevant in 1927.

"Doc" Cassie, who uses such conventional diagnostic equipment as a pitot tube for measuring air speed, sometimes uses a small mouth organ to suggest cures for noisy air systems. If necessary, he builds a scale model of the system to help analyze its faults.

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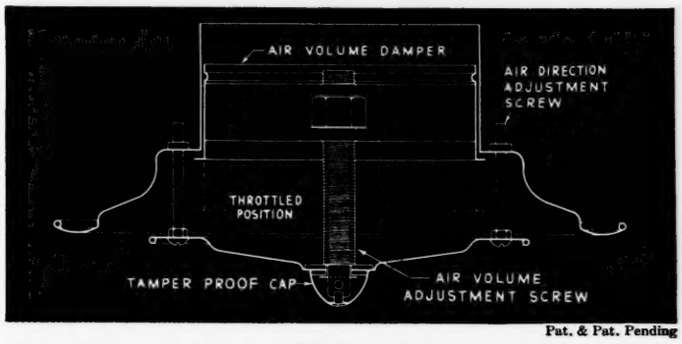

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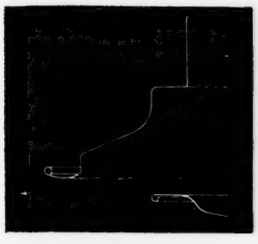

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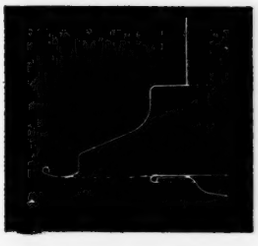

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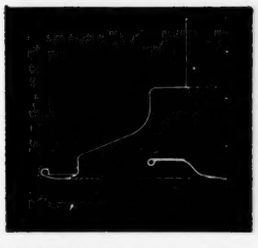

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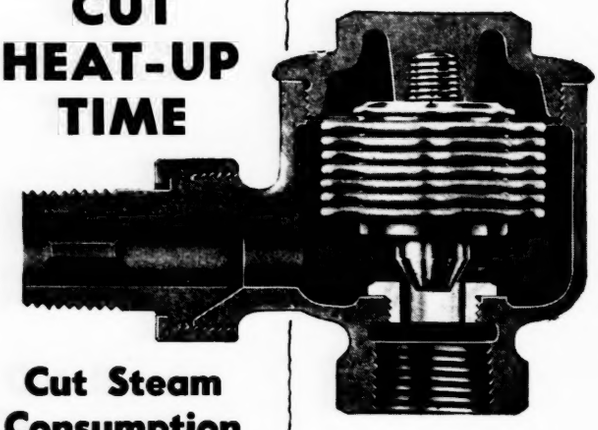
AIR DIFFUSION AIR PURIFICATION AIR RECOVERY

112 East 32nd Street — W.B. CONNOR Engineering Corp. — New York 16, N. Y.

IN CANADA: Douglas Engineering Co., Ltd., 1405 Bishop St., Montreal 25, P. Q.

New Nicholson Radiator Traps

CUT HEAT-UP TIME



Cut Steam Consumption

Utilizing a patented vapor-pressure principle which speeds action, and large-orifice valves which effect greater discharge, the new line of Nicholson radiator traps are producing 3-way savings: in heat-up time, in steam, and in fuel. Two types, for 200 and 400 sq. ft. EDR, vapor and vacuum; pressure to 25 lbs. Competitively priced.

Bulletin 744 describes new traps

W. H. NICHOLSON & CO. 199 OREGON STREET WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties

CHECK BLOWERS AND EXHAUST SYSTEMS with

The Alnor Velometer

Air velocity can be measured directly and quickly with the Alnor Velometer. This convenient instrument gives you instantaneous direct readings in feet per minute, reliable check of exhaust system operation. Extension jets permit use in ducts and many other places inaccessible by other means.

The Alnor Velometer is built in several standard ranges, 0-200 to 0-6000 fpm, and up to 20 inches static on total pressure. Special ranges available up to 24,000 fpm. Write for velometer bulletin with complete description.

ILLINOIS TESTING LABORATORIES, INC.
420 NORTH LA SALLE STREET • CHICAGO 10, ILLINOIS

Frank Steixner whose article on Air Conditioning Restaurants appeared in the November, 1946 issue HEATING AND VENTILATING is now chief engineer of the Hotel Savoy Plaza, a 1,000-room hotel in New York City. He was formerly chief operating engineer for the chain of Longchamp Restaurants in New York City.

. . . Since the Last Issue

Donald A. MacNeil has joined the sales staff of the forging division of **Tube Turns (Inc.)**, Louisville, Ky. He will make his headquarters in Chicago, in the Utilities Bldg., 327 South LaSalle Street. Mr. MacNeil was associated with the Kelly Steel Works, Inc., Chicago, for sixteen years before resigning the vice-presidency of that organization to join Tube Turns. A native Chicagoan, he attended the University of Chicago. He is a member of the Chicago Athletic Association, South Shore Country Club, Economic Club of Chicago, Western Railway Club, and the Army Ordnance Association.

D. A. MacNeil

Minneapolis-Honeywell Regulator Co. has made arrangements to lease the two-story building in Minneapolis formerly occupied by the Society for the Blind to house the Honeywell sales school and the research department. A heating plant laboratory will be set up in the basement of the new building to be used largely by students of the school.

Rudard A. Jones, architect, has been appointed a research associate professor in the **University of Illinois** to carry on a new three-year study on planning and design for use of coal in home heating. A graduate of Illinois, he has more recently been an assistant professor in engineering and architecture at Kansas State College, Manhattan, Kansas. The research, arranged through the Small Homes Council at the University, is a co-operative project financed through Bituminous Coal Research, Inc., the research agency of the soft coal industry.

The appointment of **Paul H. Dow** as sales promotion manager of **Bryant Heater Co.**, Cleveland, is announced. Mr. Dow will work with the expanded Bryant distribution organization in merchandising the company's line of gas-fired heating equipment. He comes to Cleveland from Dayton, where he has been associated with the Airtemp division of Chrysler Corp., in charge of public relations and dealer relationships. A member of Sigma Pi at Kenyon College, he had previously been with the General Electric Company.

P. H. Dow

Announcement was made on January 15th by R. H. Money, president of ASRE, of the resignation of **David L. Fiske,** secretary of that organization since 1927.

Young Radiator Co. of Racine, Wisconsin, manufacturers of heat transfer products, has announced the addition of **Ralph Rayner** to their research department. Mr. Rayner was born in Racine, Wisconsin, graduated from the Waukegan, Ill. High School; and from the University of Illinois as a mechanical engineer in 1943. During the war he served as an engineering officer on an L.C.I. in the Pacific. Formerly employed by a truck manufacturer, Mr. Rayner was a design engineer and worked with castings and forgings. Young Radiator Co. has also announced the addition of **P. J. Menden** to their heating, cooling and air conditioning division. Mr. Menden was born in Racine, graduated from the Racine High School, and attended Milwaukee Normal College and the University of Wisconsin ex-

P. J. Menden *J. P. Wahlen* *R. M. Rayner*

tension at Milwaukee. For several years he was associated with different heating and ventilating contractors in the Racine-Milwaukee area. Leaving this area, he was employed as a sales engineer by the W. H. Gilcher Company in Fairbanks, Alaska, who was a manufacturer's representative. He returned from Alaska in December, 1941. At Young Radiator Mr. Menden will assist in the development and improvement of heating, cooling and air conditioning products, as well as application engineering for the heating, cooling and air conditioning division. Also announced by Young Radiator Co. is the addition of **John P. Wahlen** to their staff of sales engineers. Mr. Wahlen was born in Urbana, Illinois, attended Lindblom High School in Chicago, and is a graduate of the University of Illinois, M. E., 1946. At Young Radiator he is a sales engineer of the heating, cooling and air conditioning division. Young Radiator has added the **Carl H. Roath Co.** to their list of distributors for the heating, cooling and air conditioning products division. This company will represent Young Radiator in the Denver area.

Jeff A. Hedden Co. and Associates of Atlanta, Ga. have been appointed to represent the **Research Products Corp.** of Madison, Wisc., in the sale and promotion of Research air filters in Georgia, Alabama, and Mississippi, it has been announced. Headquarters of the Hedden Company is 3184 Roswell Road, N.W., Atlanta.

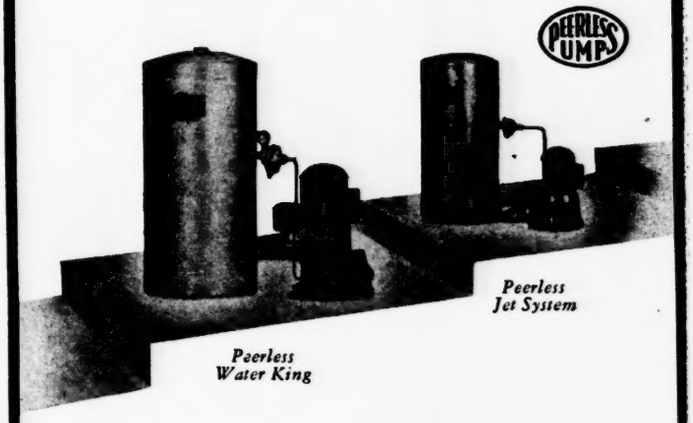
The **Heating Division, Fedders-Quigan Corp.**, manufacturers of horizontal and downblow unit heaters, announces the appointment of **C. W. Little**, formerly assistant general sales manager of the Hoffman Specialty Co., as sales manager of the division. He was also connected with Anthracite Industries and is an executive member of the National Federation of Sales Executives. Other Fedders divisions include the Radiator Division specializing on automobile and truck radiators and car heater cores.

C. W. Little

Leading coal merchants of Elkhart, Indiana, representing eighty-two per cent of the retail coal tonnage of that city, have organized **Coal Heating Service of Elkhart, Inc.**, the third group to participate actively in the program of merchandising and service which forms the basis of the Coal Heating Service plan.

2 Peerless

DOMESTIC WATER SYSTEMS . . .



2 step up { YOUR SALES YOUR PROFITS YOUR FUTURE!

Peerless Dealers WILL SELL A GOOD SHARE OF DOMESTIC WATER SYSTEMS Everywhere!

PEERLESS WATER KING For shallow well pumping. Capacities: 275 to 860 gallons per hour. The only Domestic Water System applying the "magic" water lift principle for simplicity and economy of operation. 100% automatic. Pumping element is integral part of pump base; only needs connection of suction pipe over well.

PEERLESS JET SYSTEM

For deep or shallow well pumping. Capacities: 400 to 5000 gallons per hour. Lifts: Up to 120 feet. Highly advanced, precision built for utmost economy and efficiency. Installed overwell or offset. 100% automatic.

PEERLESS DEALERS CAN OFFER THE MOST IN OUTSTANDING DEEP AND SHALLOW WELL PUMP IMPROVEMENTS

For a sound, profitable future in Domestic Water System sales, learn of the added Peerless Pump advantages of construction and operation, together with the active and extensive advertising and merchandising aids to Peerless dealers.

Write TODAY FOR FULL DETAILS

PEERLESS PUMP DIVISION

FOOD MACHINERY CORP.

Canton 6, Ohio • Quincy, Ill. • Los Angeles 31, Calif.

Branch Offices: Ardmore, Pa.; Decatur, Ill.; Atlanta, Ga.; Dallas, Texas

PIPE and TUBE BENDING
WELDING FABRICATION

Many foremost manufacturers, having discovered our specialized skill in our particular line, have entrusted us with a great variety of precision pipe and tube work, including bending, coiling, expanding, flattening, brazing and welding.

Swan engineers and technicians, dealing continually with piping, can advise on your bending requirements and offer valuable suggestions on design and economical methods of installation. We invite your inquiries.

SWAN ENGINEERING CO., Inc.

20-58 NELSON ST., BLOOMFIELD, N. J.

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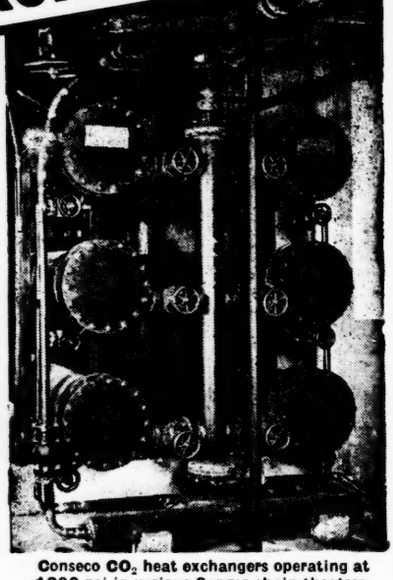
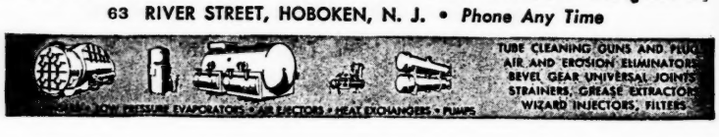
Air Conditioning HEAT EXCHANGERS

All types of heat exchangers designed, built, retubed, repaired, rebuilt. FAST, expert service. Days, nights, holidays. Quick delivery on new condensers and coolers. Twenty years' specialized experience designing, fabricating and servicing heat exchangers assure sound design, quality construction and economical operation with any type refrigerant. Engineering assistance gladly furnished. Write.



Conseco CO_2 heat exchangers operating at 1200 psi in various Sanger chain theatres.

SERVICE
CONDENSER SERVICE & ENGINEERING CO., INC.
63 RIVER STREET, HOBOKEN, N. J. • *Phone Any Time*



A new addition containing 18,600 sq ft of floor space has recently been completed at the **Marlo Coil Co. plant** in St. Louis. The new construction provides greatly increased manufacturing and assembly space, with efficient loading platforms to facilitate receiving and shipping. This marks the fourth time in 13 years that the Marlo firm has enlarged its facilities. Beginning with 750 sq ft in 1925, the plant grew to 4,000 sq ft in 1941, when the present building was erected. The new addition brings Marlo's total factory area to 42,600 sq ft, devoted entirely to the manufacture of heat transfer equipment of all kinds.

Carl W. Flesher, Pacific Coast regional director of construction for the U. S. Maritime Commission from 1942 to 1946, has become sales manager of the **Condenser Service & Engineering Co., Inc.,** Hoboken, New Jersey. Graduating from the U. S. Naval Academy in 1927, Mr. Flesher served three years at sea with the Navy before joining the marine sales department of the Westinghouse Electric Corp. In 1938 he left Westinghouse to become associated with the U. S. Maritime Commission in Washington.

The appointment of **Harold J. Sullivan** as service manager, Coal Heating Service Division, **National Coal Association,** was announced. Mr. Sullivan assumed his new duties on January 15, leaving his former position as managing director, Better Home Heating, Inc., of St. Paul and Minneapolis. As service manager of the Coal Heating Service Division, Mr. Sullivan will assist local Coal Heating Service groups in the development of their service programs for users of coal for home heating, and will supervise the planning and preparation of training programs and materials for retail coal personnel.

C. B. Phillips, vice-president of Surface Combustion Corp. was elected to the board of directors of the **National Warm Air Heating and Air Conditioning Contractors Association** in their recent board meeting at Chicago's Palmer House. Mr. Phillips long has been an active and interested member of the organization's manufacturer branch, and has done much towards furthering the association's objectives and policies.

Formation of **Kerns & MacCracken Corp.,** manufacturers of the Jet-Heet Furnace, described as "a revolutionary new low-cost heating unit, utilizing the principles of the jet engine," was announced by Homer Kerns, president of the new company, and Calvin Dodd MacCracken, the inventor, executive vice-president.

INDUSTRIAL DEGREE-DAYS
December, 1946

City	55F Base	45F Base
Baltimore, Md.	396	157
Buffalo, N. Y.	727	443
Chicago, Ill.	657	386
Cleveland, Ohio	651	374
Detroit, Mich.	710	430
Indianapolis, Ind.	547	290
New York, N. Y.	527	248
Philadelphia, Pa.	469	203
Pittsburgh, Pa.	587	318
St. Louis, Mo.	452	224

CANADIAN DEGREE-DAYS FOR DECEMBER, 1946*

City	December 1946	December Normal	Cumulative, Sept. 1 to Dec. 31 1946	Cumulative, Sept. 1 to Dec. 31 Normal
Calgary, Alta.	1476	1426	4092	3702
Charlottetown, P. E. I.	1277	1246	2725	2865
Crescent Valley, B. C.	1178	1240	3364	3279
Edmonton, Alta.	1782	1578	4503	3984
Fort William, Ont.	1671	1596	3917	3815
Grande Prairie, Alta.	1996	1649	4774	4159
Halifax, N. S.	1099	1138	2407	2615
London, Ont.	1141	1200	2380	2677
Medicine Hat, Alta.	1513	1417	3960	3389
Moncton, N. B.	1352	1373	2935	3186
Montreal, P. Q.	1357	1407	2820	3096
North Bay, Ont.	1528	1528	3357	3503
Ottawa, Ont.	1410	1494	2971	3277
Penticton, B. C.	1094	1073	2891	2626
Porquis Junction, Ont.	1739	1786	3951	4248
Prince George, B. C.	1451	1504	4109	3757
Quebec City, P. Q.	1472	1534	3105	3511
Regina, Sask.	1928	1779	4727	4336
St. John, N. B.	1228	1271	2640	2969
Saskatoon, Sask.	2034	1767	4821	4249
Toronto, Ont.	1108	1155	2243	2644
Vancouver, B. C.	849	818	2403	2168
Victoria, B. C.	781	738	2186	1910
Windsor, Ont.	1060	1172	2069	2446
Winnipeg, Man.	1841	1829	4368	4205

*These data are supplied through the courtesy of the Meteorological Division, Air Services Branch, Department of Transport, Canada, with the cooperation of N. W. Etter, Heating Engineer, Enamel & Heating Products Limited, Sackville, N. B.

The Department reports a slight revision in the figure for November for Grande Prairie, Alta., as published in last month's issue. Corrected figure is 1506.

COMING EVENTS

MARCH 24-29, 1947—Annual Convention, Oil Heat Institute of America, at Hotel Traymore, Atlantic City, N. J. For details write the institute at 30 Rockefeller Plaza, New York 20, N. Y.

MARCH 31-APRIL 2, 1947—Ninth annual meeting of the Midwest Power Conference, Palmer House, Chicago, Conference will be sponsored by the Illinois Institute of Technology in cooperation with nine midwestern colleges and seven engineering societies. Further information obtainable from Stanton E. Winston, Dean of the Evening Division, Illinois Institute of Technology, 41 W. 33rd St., Chicago 16, Ill.

APRIL 7-10, 1947—Annual Convention of The National Association of Corrosion Engineers, Palmer House, Chicago. For details write Elton Starrett, Executive Secretary, 905 Southern Standard Bldg., Houston 2, Texas.

JUNE 16-19, 1947—38th annual meeting of the National District Heating Association, at the Ambassador Hotel, Atlantic City, N. J. Further information from the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa.

DECEMBER 2-5, 1947—Annual meeting of The American Society of Mechanical Engineers, at New York City, or Atlantic City, N. J.

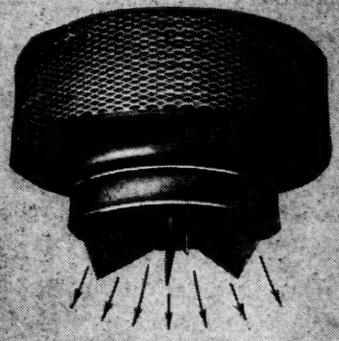
JANUARY 26-29, 1948—Fifth All-Industry Exposition of the Refrigeration Equipment Manufacturers Association, at Cleveland Public Auditorium, Cleveland, Ohio.

McCORD
HEATING AND AIR CONDITIONING PRODUCTS

BLAST HEATING COILS—AIR CONDITIONING COILS—ALL TYPES

All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

VERTICAL TYPE UNIT HEATERS



A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

HORIZONTAL TYPE UNIT HEATERS

A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

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